MACHINERY

Design—Construction—Operation

Volume 40 | MARCH, 1934 | Number 7

PRINCIPAL ARTICLES IN THIS NUMBER

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DEPARTMENTS

The extrusion of thin metal tubes only 0.005 inch thick, such as are used for tooth paste, shaving cream, and similar purposes, is one of the most ingenious applications of the extrusion process. April MACHINERY will describe the methods of a leading plant engaged in this work in the article *From Slugs to Tooth Paste Tubes.* Another subject full of interest at the present time, covered in April, is *How to Reduce Tool Costs with Arc-Welded Construction.*

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MACHINERY

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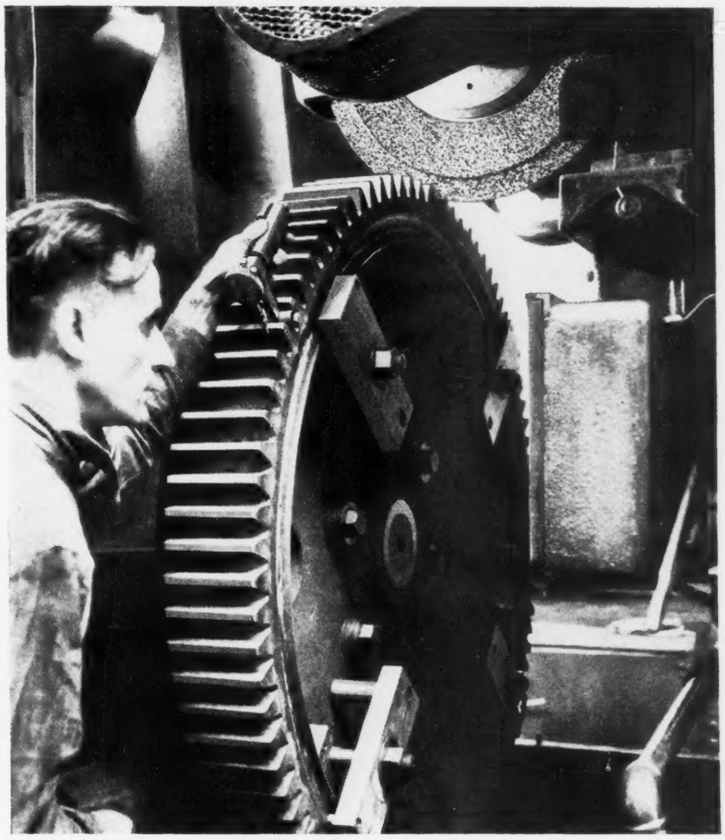
The Wide Range of Gear-Tooth Grinding

By FRED A. WARD, Chief Engineer
The Gear Grinding Machine Co., Detroit, Michigan

The Grinding of Gear Teeth is Being Successfully Applied to Work Ranging All the Way from Huge Gears for Driving Electric Locomotives Down to Gears as Small as One-Half Inch



WHEN ground-tooth gears are spoken of, most mechanical men think of automobile transmission gears. It is true that the great majority of ground gears are used in automobile transmissions, but the field is by no means limited to that application. Ground-tooth gears of 52 inches pitch diameter, with teeth of 1 3/4 diametral pitch, are driving electric locomotives at speeds up to 100 miles an hour. The heading illustration shows one of these large locomotive gears having its teeth ground in the Nuttall Works, Pittsburgh, Pa., of the Westinghouse Electric & Mfg. Co., while Fig. 1 shows a number of locomotive gears after the tooth-grinding operation.

Ground gears are also being used on steel rolling mills, because it is known that inaccurate gears are heavy consumers of power; they are being used by the United States Navy Department for driving torpedoes quietly through the water; and they are being used on machine tools, airplanes, the pumps of fire-fighting equipment, and even on farm tractors.

Grinding is a convenient means of finishing gear teeth after hardening processes to eliminate the distortion that invariably occurs during heat-treatment. One of the important advantages derived from gear-tooth grinding is that the teeth do not need to be finished to extreme accuracy prior to the

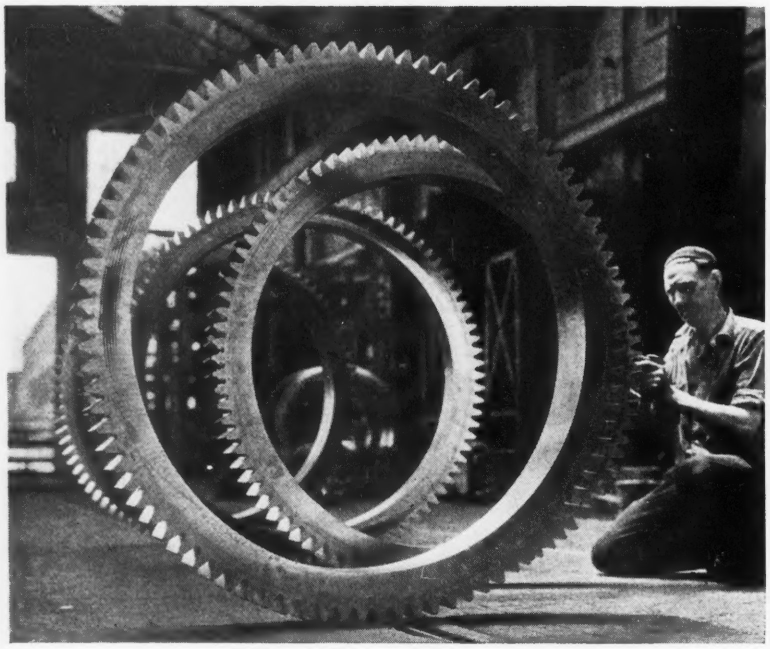


Fig. 1. The Large Gears Here Shown were Ground in the Teeth to Insure the Smooth Driving of Huge Electric Locomotives

heat-treatment. When gears that will later be ground come to the heat-treating department, the excess stock on the tooth width may range from 0.008 to about 0.015 inch; and there may be similarly broad tolerances on the tooth spacing, shape of teeth, and relation of teeth to the axis of the gear. The only requirement is that there be sufficient stock to enable high accuracy to be attained in the grinding operation.

Because of the wider tolerances possible, the machines and cutters used in producing the gear teeth do not need to be kept as highly accurate as they otherwise would. Since gear-tooth grinding permits savings in preceding operations, it should not be considered an added expense.

The amount of gear-tooth distortion occurring in hardening depends principally upon the design of the gears and upon the heat-treating practice. In the case of torpedo gears, the design is such that distortion in heat-treatment cannot be avoided; and if the teeth were not ground, only a very small percentage of these gears would pass government inspection. On very large gears the distortion may be so great that the gears simply cannot run together unless the teeth are ground. If the electric locomotive gears shown in Fig. 1 were not ground in the teeth, constant vibration might be set up in their operation due to inaccurate teeth. In such a case, the grinding of gear teeth may be a practical necessity.

On ground gears for automobile transmissions, the pitch circle must usually be concentric within 0.001 inch. Tooth spacing is held to the nominal dimension within from 0.0005 to 0.001 inch, de-

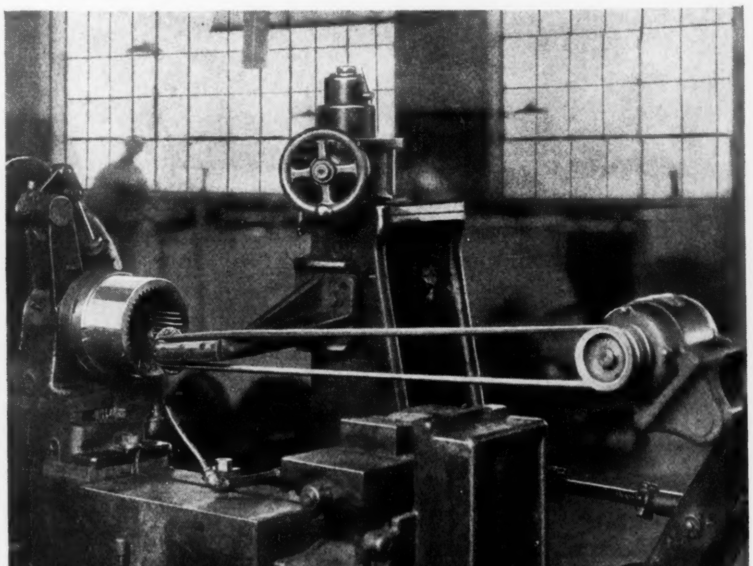


Fig. 2. Internal Gears as Small as 3 Inches in Pitch Diameter are Ground in the Teeth with the Equipment Illustrated

Fig. 3. Ground-tooth Gears Have Contributed Materially to the Quietness of Automobile Transmissions

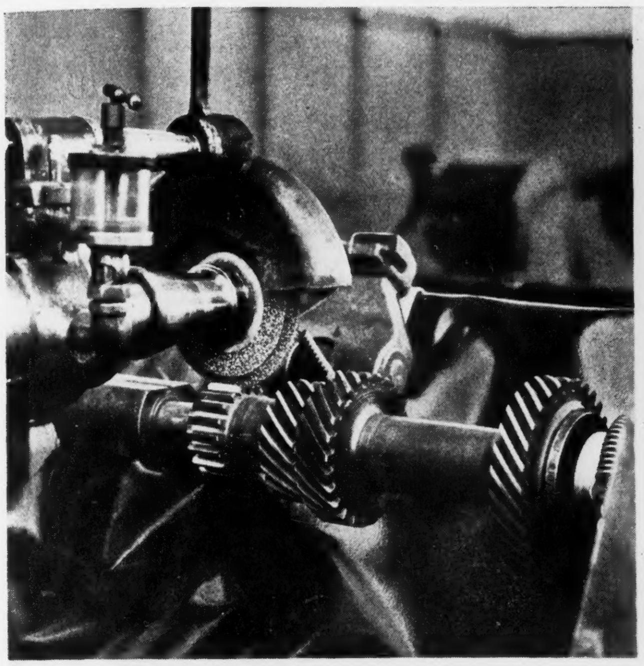
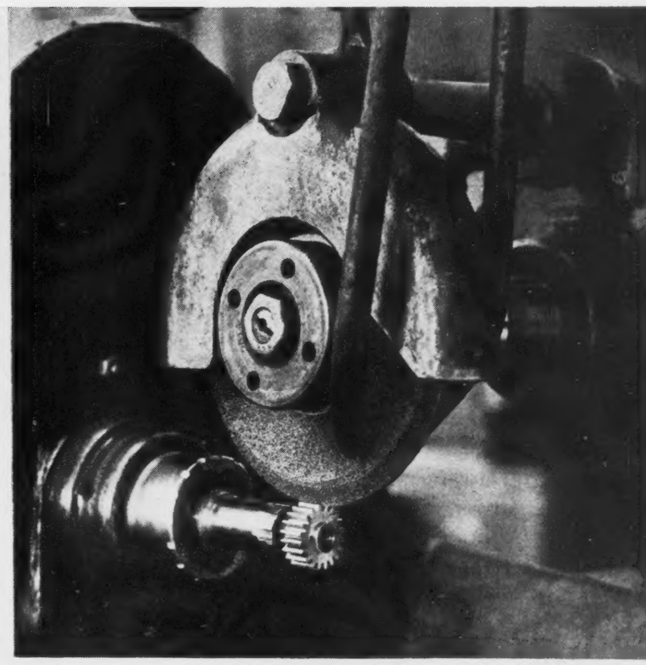


Fig. 4. Spur Gears as Small as 1/2 Inch in Diameter are Being Ground for Use in Weighing Machines



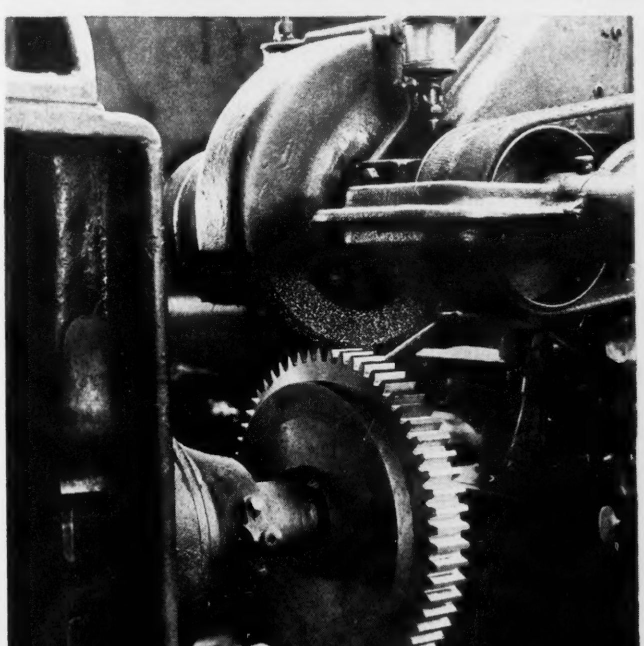


Fig. 5. Grinding a 12-inch Gear to be Used for Driving the Ram of a Machine Tool without Vibration

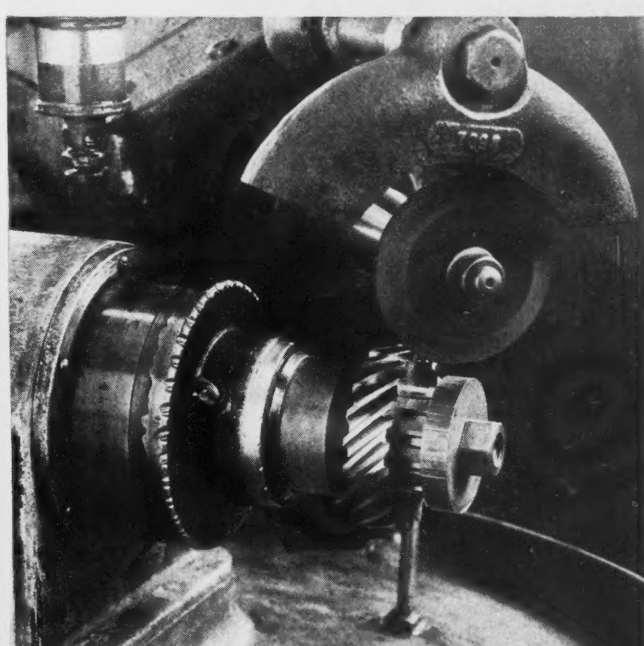


Fig. 6. Helical Gears are Ground by Rotating the Gear while it is being Traversed Past the Grinding Wheel

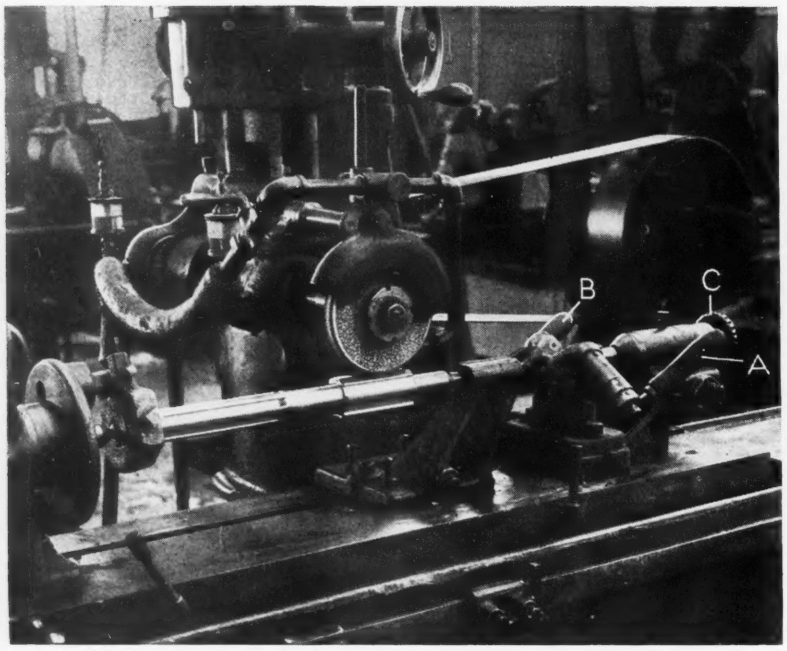


Fig. 7. Splines of the Square Type or of the Involute Type are Being Ground with Wheels Formed to the Outline of the Spline Sides and Bottom

pending upon the quality of the automobile being built. The tooth form is generally a modification of a true involute curve, but the amount of modification is exacting and should be maintained within 0.0002 inch. The helix of helical gears must generally be true within 0.0001 inch for each inch of gear face.

All of the gear-tooth grinding machines illustrated in this article were built by The Gear Grinding Machine Co. The fundamental principle of the machines made by this concern is the use of a grinding wheel that is formed to shape and size for simultaneously grinding the adjacent sides of two teeth. In grinding the teeth of spur gears, either the grinding wheel traverses back and forth between the teeth or the gear moves back and forth relative to the wheel. The gear has no rotary movement, except for indexing from tooth to tooth between successive passes. Diamonds for truing the grinding wheels are controlled by master forms that are six times the size of the teeth being ground. The traversal of the wheel or work and the indexing of the gears are performed hydraulically.

The practice is to take several rough-grinding cuts around a gear, the number depending upon the amount of stock to be removed. Approximately 0.001 inch of stock is left on the total tooth thickness for the final finish-grinding cut. The grinding wheel may be trued several times during the rough-grinding, and it is always dressed prior to the finish-grinding. Truing is accomplished by merely moving the wheel-head back to a point where three diamonds are located. These diamonds are then moved across the edge and sides of the wheel by merely operating two handles. The kind of wheel employed depends upon the material from which the gear is made. Soft, vitrified wheels are used principally. Regular grinding compound is delivered to the wheel and work copiously.

In grinding cluster gears, as shown in Fig. 3, the gears may be spaced as close together as 1 inch, because grinding wheels as small as 1 1/2 inches in diameter can be used in close quarters. In the operation shown, the work-table moves back and forth beneath the wheel.

Gears as small as 1/2 inch in diameter, with teeth as fine as 32 diametral pitch (0.0982 inch circular pitch), have been ground in machines of this type. There is practically no limit to the size of gear that can be ground, provided the work-support does not interfere with the grinding wheel. Fig. 4 shows an operation on a gear of about 1 1/4 inches pitch diameter. In grinding spur gears, four or five gears can frequently be mounted on an arbor and ground in one operation.

In Fig. 5, a ring gear about 12 inches in diameter is being ground for driving a machine tool slide smoothly. In this operation, the wheel-slide moves back and forth, while the gear remains stationary, except for indexing. The gear is adjustable vertically instead of the grinding wheel. Power is transmitted to the grinding wheel by a belt on each side, so as to insure a smooth vibrationless drive.

Helical gears are ground on a machine of a different type from those thus far referred to. As shown in Fig. 6, the gear is mounted on a quill that slides back and forth in the work-head to carry the gear past the grinding wheel. At the same time, the quill swivels or rotates about its axis to suit the helix angle of the gear teeth. This swiveling action is controlled by a grooved master quill having the same helix angle as the gear teeth. The axis of the grinding wheel remains in one position during the operation. Indexing of the gear is accomplished automatically between successive passes of the work.

Internal gears down to about 3 inches in diameter can be ground in the teeth by the method illustrated in Fig. 2. The comparatively small grinding wheel is driven, on each side, by narrow fabric belts

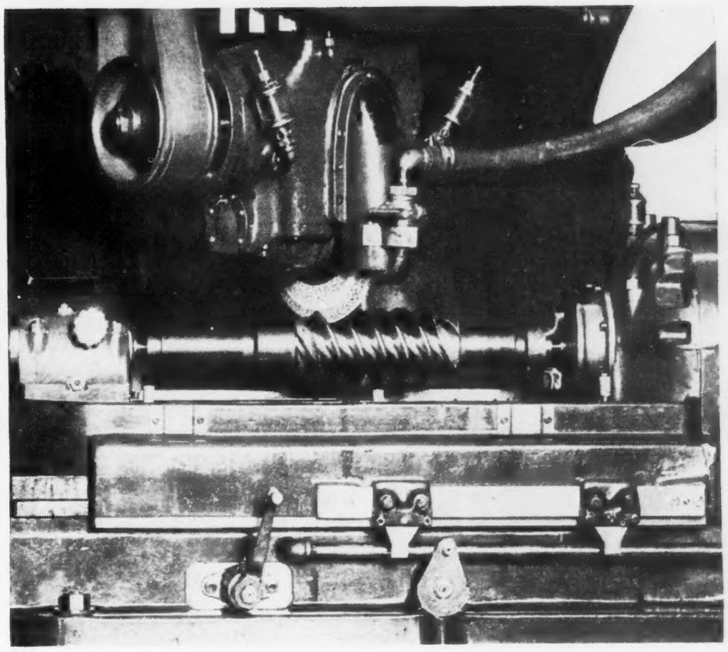


Fig. 8. The Grinding of Worm Threads is Accomplished by Means of a Formed Wheel which Simultaneously Grinds the Adjacent Sides of Two Threads

connected to a pulley on the motor at the right. The motor is mounted on a hinged bracket, so as to insure a uniform belt tension. In this operation, the work-table moves back and forth. Indexing of the gear, as well as the table reciprocation, is accomplished automatically.

Racks are ground similarly to spur gears, with the exception that accurate indexing from tooth to tooth is insured by engaging a tooth-shaped plunger in the teeth of a master rack. The master rack is attached to the table in front of the wheel. With this arrangement, racks have been ground so carefully that the cumulative error in a length of 24 inches was only 0.0002 inch. On commercial jobs, the cumulative error is not more than 0.0005 inch.

The grinding of straight splines by means of a formed wheel is illustrated in Fig. 7. Both series of splines on the shaft shown are of the square type, but involute splines can be ground just as readily. Helical splines are being ground in shafts to facilitate the engagement of helical gears mounted on the shafts.

In this illustration, the diamond truing devices can be seen clearly at the right-hand end of the table. The sides of the grinding wheel are dressed by operating handles *A* and *B*, while the periphery of the wheel is trued by turning knob *C*.

The use of a formed wheel for grinding worms is illustrated in Fig. 8. This operation differs from those previously described in that the shape of the wheel is not exactly the same as that of the surfaces ground by it. Worms up to 8 inches in diameter can be ground in the machine illustrated, with any helix angle up to 45 degrees. The work-table is traversed horizontally by a screw having the same lead as the worm being ground. At the same time, the worm turns at the proper rate for grinding the thread to the desired helix. The work-head is equipped with an index-plate for multiple-thread grinding.

Reducing the Time for Malleableizing Cast Iron

The Committee on Industrial Gas Research of the American Gas Association has been making an intensive study of the time element in the malleableization of cast iron. By the ordinary process, high-temperature furnaces must be used and great quantities of heat are employed. From the time the cast iron enters the furnace until it is removed in the malleable state, over one hundred hours must elapse.

The investigations conducted in the laboratories of the University of Michigan at Ann Arbor show that it is possible to shorten the cycle of malleableizing to twenty or twenty-five hours by a series of processes evolved in the laboratory. However, just as showing television pictures in the laboratory does not put television sets into the average home, so cutting the time for malleableizing cast iron from one hundred to twenty-five hours in the laboratory does not make the method immediately available in the foundry. It is believed, however, that the new method can be made of practical value in everyday foundry practice.

* * *

In 1933, about 233,000 American motor cars were sold abroad, or 11.5 per cent of the production. The value of the exports was $135,000,000.

A Simple Method of Aligning Punch and Die Members

Rapid and Accurate Alignment of Irregular-Shaped Punches with the Die Holes is Assured Regardless of Punch Clearance

By WILLIAM C. BETZ, Master Mechanic
Fafnir Bearing Co., New Britain, Conn.

FOR accurately locating irregular-shaped punches in progressive blanking and forming dies, the method known as "floating punch or die location" has been found by the writer to be the simplest and most rapid. To employ this method, however, punches and dies of the type shown in Figs. 1 and 2 must be used. There are three ways outlined here in which the method may be applied.

One way of aligning the punch and die is to complete the die first, and then fit the punches in their proper die stations. Following this, the punches are hardened for a distance of about half their length from the cutting end. After hardening, the punches are carefully ground to the same length on their top and bottom faces and at right angles to their center lines. All dowel-pin and screw holes are now drilled and counterbored in the punch-plate, the location of these holes being obtained approximately from the centers of the die openings.

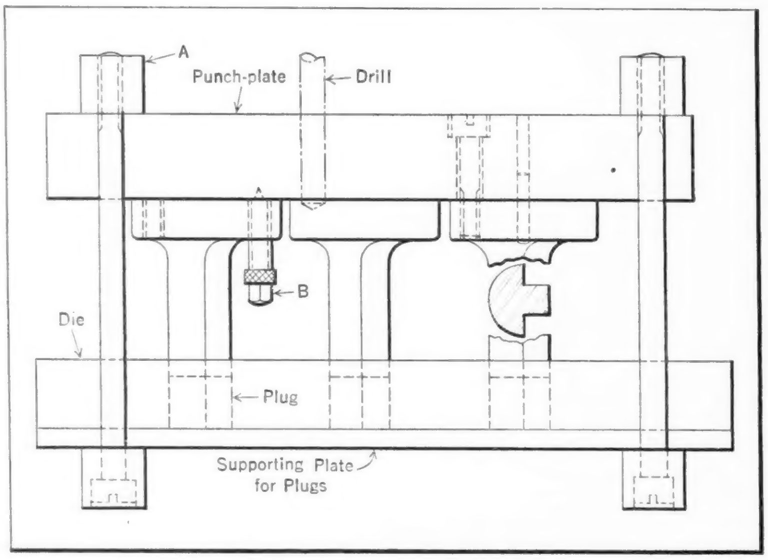


Fig. 1. Blanking Die Equipped with "Floating" Punches to Facilitate Accurate Alignment. Screw-punch B Locates the Screw-holes in the Punch-plate

As indicated in Fig. 1, the punches are inserted in the die openings and rest on special plugs of a given length. These plugs are supported by a plate on the bottom of the die, allowing the punches to enter the die about 1/4 inch. The punch-plate is placed in position on the punches and the entire assembly is held together by the clamps *A*. Great care must be exercised in tightening these clamps to have the bottom of the die and the top of the punch-plate parallel. Their parallelism can be easily checked on a surface plate by means of a surface gage equipped with an indicator.

After checking, the screw and dowel holes in the punches are drilled, the clamp bars resting on the drilling machine table for this operation. The holes are then tapped and the screws and dowels inserted, after which the clamps are removed.

Another way of aligning the punches with the die holes is first to drill, ream, and tap all holes in the punch shoulders and then harden the punches all over. The procedure already described is followed in clamping the die members together. Screw *B*, having a 60-degree point, is inserted into each screw hole in the punches and tightened to mark the punch-plate.

The clamps are then removed and the punch-plate drilled and counterbored 1/64 to 1/32 inch larger than the bodies and heads of the screws. This arrangement permits the punch to float when locating it in the die holes. The punch-plate is now placed on the punches and clamped as before, with the ends of the punches in the die holes. The punch screws are now assembled tightly, after which the clamps are removed and the punches withdrawn from the die. The dowel-holes are next drilled and reamed in the punch-plate and the dowels driven in place. In this way, the dowel-holes already drilled in the punch shoulders serve as a jig for drilling the dowel-holes in the punch-plate.

How Punches with Die Clearance are Aligned

With the method just outlined, it is assumed that the punches are a close fit in the die. To locate punches that have clearance, or are smaller than the die opening, it is necessary to enlarge the

punches temporarily to make a good fit in the die. This may be done in two ways: First, the punches are polished to remove all scale for at least 1/2 inch from the cutting ends. They are then heated and thoroughly tinned, all surplus solder being wiped off with a coarse cloth while hot. This leaves a solder deposit about 0.001 inch thick. If a heavier deposit is required than can be obtained with the solder, the punches can be copper-plated on the ends to add any thickness desired up to 0.003 inch.

The other way of compensating for die clearance is to shear and file the punches to fit the die openings and align the punches on the punch-plate while they are in the unhardened state. After being parts are clamped together in practically the same manner as in locating the punches from the die, with the exception that the punch-plate and bolster take the place of the clamping bars. The holes for the screws that are to hold the die sections to the die-shoe, are located with the special punch shown at *A* in Fig. 2. The end of this punch is inserted in the hole, with its nut *B* against the punch shoulder. By the aid of two pieces of drill rod inserted in the cross-holes in the screw-head and nut, the nut is prevented from turning and the punch is turned to force the point into the bolster. This operation is repeated for each screw-hole. After marking the screw-holes in this way, the clamping screws are

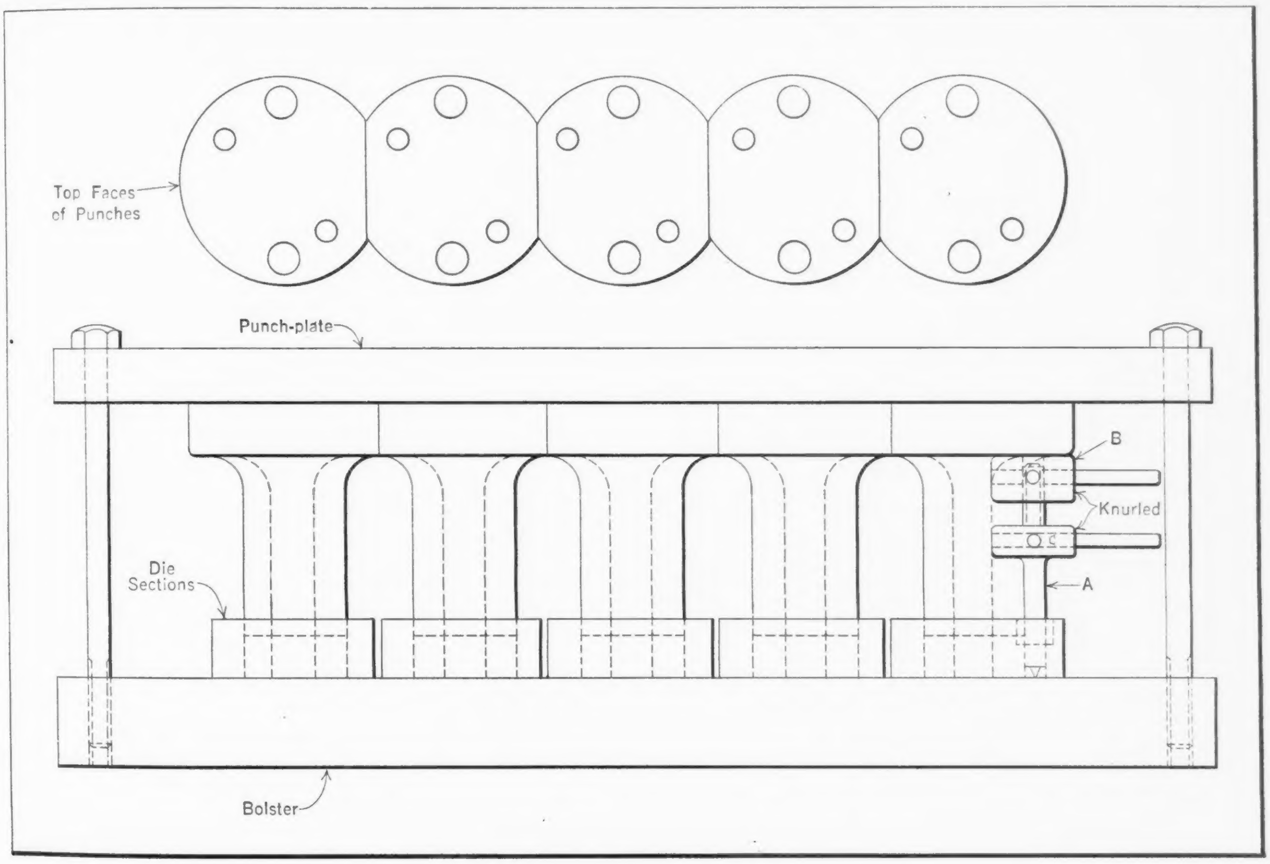


Fig. 2. Here the Die is the Floating Member, and the Screw-holes are Located in the Bolster by the Screw-punch A

aligned, they are filed for clearance in the die holes and then hardened.

Aligning the Punch when the Die is the Floating Member

It is sometimes more convenient to use floating dies than floating punches. In this case, all punches may be located and secured to the punch-plate after having been sheared and fitted to the die sections. The punches are then hardened; or, if clearance is provided, they may be plated or tinned, or they may be left soft, and the clearance filed after the die sections have been located on the die bolster.

To locate the die sections from the punches, the removed and the bolster is carefully spotted and drilled with a small center reamer. The holes are then drilled and tapped.

It might be mentioned that, as in the case of the punch screw-holes, the screw-holes in the die sections are made 1/64 to 1/32 inch over size for both the head and body of the screws. This is done to allow the die to float, or find its correct position relative to the punch, before drilling and reaming the bolster for the dowel-pin holes. To drill these holes, the punches are again inserted in the die sections and the sections screwed down tightly on the bolster. The punches are then removed from the die, the dowel-holes in the die sections are drilled and reamed, and the dowels driven in place.

The Increasing Use of Coolant Filters

COOLANT filters for cleaning coolant, removing from it grinding dirt and dust, as well as fine chips due to machining operations, are being introduced to an increasing extent in industry. In the past, they have been generally applied to grinding machines, but it is likely that they will be used for other machining operations as well, in the future.

One grinding machine builder mentions that coolant filters have been used most extensively in connection with the grinding of cold rolls. The rolls employed for cold-rolling must be ground to an exceedingly high finish. It has been found that the surface of these rolls is often scratched during the finish-grinding operation because abrasive particles, as well as minute chips, are carried between the grinding wheel and the work by the coolant. A filter inserted in the coolant line will catch these particles and prevent scratches on the work.

These filters, however, may be used for a great variety of work. In fact, whenever a high finish free from scratches is desired, one grinding machine manufacturer states that it is well to use a filter. Piston-grinding machines have been equipped with filters, and in several installations of crank-grinders, filters are employed. In the latter case, the filters are especially valuable because of the large amount of stock removed and the quantity of abrasive particles and metal grit that is in suspension in the coolant. No doubt, as time goes on, says this manufacturer, filters will be more generally used on grinding equipment of various kinds.

Another manufacturer states that one of the difficulties encountered in connection with the use of coolant filters is due not to the filters, but to the human element. The operator is supposed to turn a knob or lever for cleaning the filters after they have been in use for some time. This he frequently fails to do. It is, therefore, very necessary to impress upon the operators the importance of cleaning the filters and to see that this is done regularly.

Still another grinding machine manufacturer says: "We find that filters improve the wheel action by keeping the dirt and chips away from the face and sides of the wheel. This applies particularly to operations like crank-bearing and crankpin grinding, where the sides of the wheels are in contact with the work to quite a depth. Without filters, the sides have a tendency to fill up and sometimes cause the wheels to cut wider than their own width. This makes the pins too long.

"On any fine, high-finish work like roll-grinding, filters are quite desirable, and frequently, when they are not available, we use clear water and drain it away so as to prevent the coolant from carrying any chips back to the work and scratching it.

"Many large concerns with big grinding departments, like the Ford Motor Co., have central cooling systems with large filters integral in the system. We believe that the use of filters is quite a help in grinding and that their use will increase. Several filter companies have been advertising and selling these filters. We have been receiving orders from customers to apply them to grinding machines which they purchase."

An acknowledged authority on coolants and cutting oils states that wherever the filters are given proper care, they have given excellent results and keep the cooling fluid cleaner, thus preventing marring of the work, especially in grinding operations. This engineer believes that the general use of filters would constitute a great saving in the cost of cutting lubricants, as it would not be necessary to clean out the storage tanks of machines as frequently as now. He also believes that it is safer for the operators to work with filtered cutting fluids, owing to the fact that many infections are due to small particles of dirt and metallic chips which cause abrasions when the hands are rubbed with waste.

"In many cases," says this engineer, "we supply our customers with fine-mesh bags for use in filters. They have proved very satisfactory. There are also at least two mechanical filters on the market that are giving satisfactory results, and I hope in the near future to see the filtering of cutting lubricants a standard practice in all metal-cutting plants."

* * *

General Electric Group Insurance

More than $10,000,000 has been paid to employes and families of employes of the General Electric Co. in death and disability benefits under group life insurance plans up to the present time. A total of 4360 families and more than 600 permanently disabled employes have been the recipients of these payments. This represents an average to each beneficiary of more than $2000, made available in time of distress and often of dire need. The group life insurance plan of the General Electric Co. was put in effect in 1920. Of the payments made, over $5,000,000 are on account of free policies provided by the company; the other $5,000,000 are on account of group policies paid for by the employes, in addition to the policies which are paid for by the company.

Honing Interrupted Bores

Method of Producing a Mirror Finish on Bored Surfaces that are Interrupted by Keyways, Ports or Other Openings

By
KIRKE W. CONNOR
President
The Micromatic Hone Corporation
Detroit, Mich.

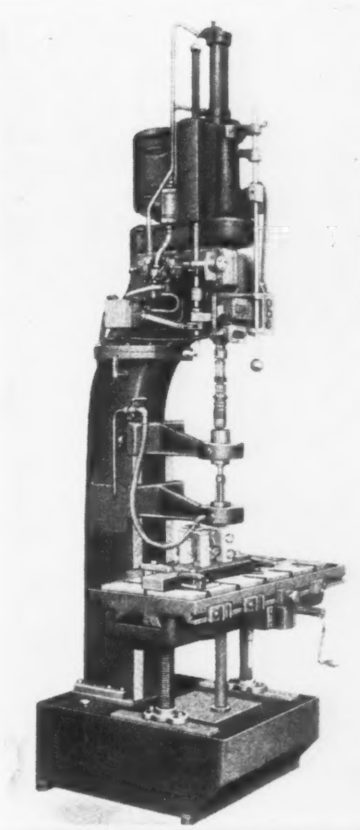


Fig. 2. Hydraulic Honing Machine with Electric Device for Stopping the Operation after a Certain Number of Strokes

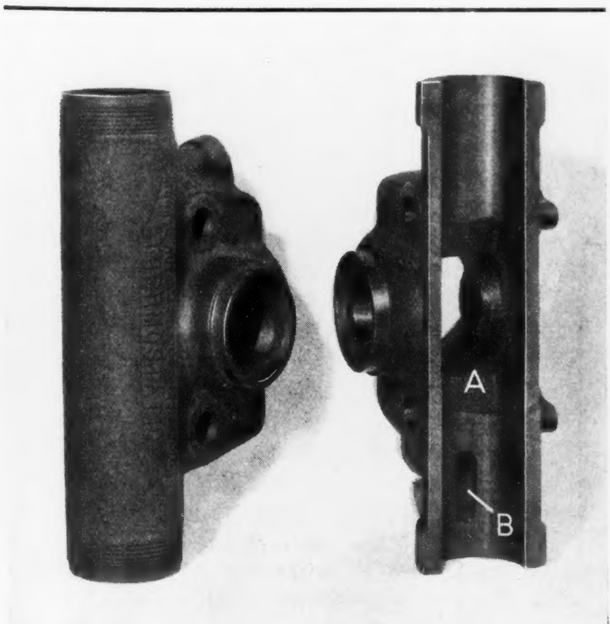
HONING has been confined largely in the past to the finishing of bores that were considerably greater in length than in diameter. Recent developments, however, have made possible the honing of medium-sized holes of approximately the same length as their diameter. Not only this, but the bores can be honed to within close limits of roundness and parallelism, even though they are broken by keyways, slots, ports, or other openings, instead of being uninterrupted cylindrical surfaces.

Honing Across Openings in a Shock Absorber Cylinder

The honing of a part such as illustrated in Fig. 1 would have been considered impracticable not very long ago because the bore must be smooth and constant on one side for a length of 7 inches, while on the other side it is interrupted by openings *A* and *B*. The first of these openings *A* is approximately 3 inches long by 1 inch wide, while the other hole *B* is 1 inch long by 1/4 inch wide. This part is a cast-iron cylinder for the hydraulic shock absorbers manufactured by the Monroe Auto Equipment Co., Monroe, Mich. The nominal diameter of the bore is 1 5/16 inches.

This shock absorber cylinder is first bored with a tungsten-carbide tool and then honed to size within plus or minus 0.0003 inch, about 0.002 inch of stock being removed. For the operation, the part is held vertically in the fixture of the machine illustrated in Fig. 2. This hone is operated hydraulically, and the machine is provided with an electrically controlled stroke-counting device. When the operator presses a button to start an operation, the machine spindle descends, carrying the hone to the work, and then makes a predetermined number of strokes, as controlled by the counter, at the end of which the hone is automatically lifted out of the work. This machine is built by the Barnes Drill Co., Rockford, Ill.

Fig. 1. Shock Absorber Cylinder with a Long Bore, Interrupted by Openings A and B, that is Finished by Honing



In the operation being described, the hone is allowed to make 35 cycles at the rate of 96 complete cycles per minute. Both the downward and upward movements are considered strokes, while a cycle is taken to mean a combined downward and upward stroke. The working stroke is 5 inches long, the abrasive stones being 4 inches long and projecting 1 inch from the top and bottom of the work at the ends of the stroke. The floor-to-floor time in this operation is 30 seconds, the actual honing taking 22 seconds. The hone runs at a speed of 400 revolutions per minute.

Success in this operation is due to the use of a hone developed by the Micromatic Hone Corporation, which automatically expands during its reciprocation and collapses on the last stroke when the

part has been finished to size, ready to be fed out to the starting position. Automatic expansion of the abrasive stones occurs as the three fingers *A*, Fig. 3, enter a guiding and sizing bushing when the hone is lowered into the work. As the upper ends of these fingers are swiveled toward the center of the hone assembly, the pressure which they exert through collars and a ball thrust bearing on sleeve *B* is relieved. This enables the bar type spring *C* to expand slightly, which moves cone *D* downward relative to the cam-backed abrasive holders *E*. In this way, the abrasive holders are automatically moved outward for the operation.

Spring *C* is maintained under a predetermined pressure by means of adjustment collar *F*, so that during each honing operation spring *C* feeds holders *E* outward at a constant rate until the spring has reached the limit of cage *G*. Thus the hone cannot expand any more than is permitted by the lengthwise expansion of spring *C*.

Each stone-holder *E* has only one point of contact on cone *D*. This feature permits each stone to rock independently of the others, so that uneven wear of the stones can be compensated for. Cone *D* is made to a pitch that is beyond the angle of reversibility, so that it is impossible for any pressure on the abrasive stones to reverse the action of the expanding mechanism. Hones of similar design have been used in the past for finishing automobile cylinders, but it is only recently that they have been applied to bores of small diameter.

In honing parts with interrupted bores, the hone is enabled to bridge the openings by its combined rotary and reciprocating action, which causes the hone to move across keyways, slots, or other openings in a helical path. Also, the honing stones are made

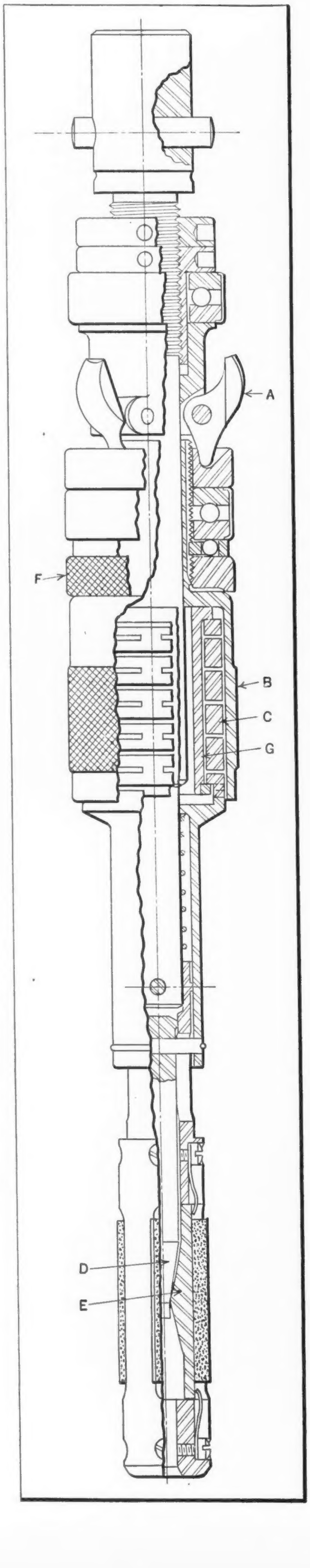


Fig. 3. A Hone that Automatically Expands during Honing until the Work has been Finished to the Desired Diameter and then Collapses for Withdrawal from the Work

long enough to span the length of any openings, so that the ends rest on solid metal. The hone will follow each bore only so far as alignment is concerned; thus the walls of a tapered hole will be made parallel and finished to the diameter of the expanded hone. In the operation on shock absorber cylinders, from 1000 to 1200 bores are finished before the abrasive stones are ready to be discarded.

Honing across Keyways and Slots

The cast-iron valve-tappet guide shown at the right in Fig. 4 has four holes that are 2 1/8 inches in diameter by 2 inches long. A keyway 3/16 inch square extends the full length of each bore. In addition, the bores are cut away on one side along the bottom of the casting, as indicated at *A*, the recess being 5/16 inch deep on the outside bores and 1/8 inch on the inside bores.

The keyways are cut after the bores have been reamed, because of the impracticability of reaming across the edges of the keyways. Also, the slots at the bottom ends of the bores are milled after the reaming. These operations subsequent to reaming made it impossible to hold the bores closer than 0.001 inch for roundness until honing was adopted, even though the bores were reamed to size within 0.0004 to 0.0005 inch.

Honing by means of the same type of tool as used in the operation previously described corrects the valve-tappet guides to within from 0.0002 to 0.0003 inch, as determined by gaging across the bores from the sides of the keyways and also at right angles to the keyways. About 0.0015 inch of stock (on the diameter) is removed in the honing, the operation taking 16 seconds. Sixty cycles are made, the hone reciprocating at the rate of 230 cycles per minute. Each stroke is 1 1/4 inches long, and the abrasive stones are 2 inches long by 3/8 inch wide by 3/16 inch thick. The hone revolves 400 times a minute.

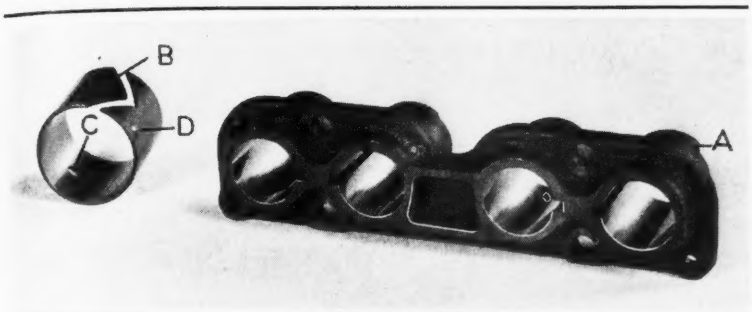


Fig. 4. A Roller Bearing Shell and Valve-tappet Guide which are Finished by Honing, in Spite of the Fact that the Bores are Interrupted by Keyways, Slots, and Other Openings

Steel shells such as illustrated at the left in Fig. 4 are being used as outer races for roller bearings in automobile rear-axle tubes. It will be seen that the shell is split by a V-shaped slot *B* and that it has a 1/4-inch hole *C* opposite the slot. There is also a depression about 1/4 inch in diameter that is produced by forming the locating boss *D*. This bearing race is 1 11/16 inches in inside diameter by 1 13/16 inches long. The wall is approximately 1/16 inch thick.

Slot *B* is about 1/4 inch wide when the bearing is free, but when it is placed in a fixture for honing, the slot is only 3/32 inch wide. From 0.0007 to 0.001 inch of stock is removed on the diameter by a hone that expands and contracts automatically, as in the case of the two previous jobs mentioned. The actual honing time is 10 seconds, and the floor-to-floor time 20 seconds. Forty strokes are made at a speed of 240 cycles per minute. Each stroke is 1 1/2 inches long and the abrasive stones are 3 inches long.

Honing is the only operation performed on the bore of these races. They are merely punched and rolled from strip stock prior to the honing.

Research Work Must be Carried on Systematically

By P. H. BRYANT

The chief engineer of a well-known manufacturing company recently installed a new heat-treating department equipped with the most up-to-date furnaces, hoping to be able, with these facilities, to obtain definite predetermined results in heat-treating. For years it had been his ambition to develop a means by which to determine and tabulate exactly how a given piece of steel would behave under carefully controlled conditions. The new equipment, however, did not enable him to do this.

The engineer concluded that he would have to conduct experiments of his own in order to obtain the results that he wanted. A bath was used in the furnaces for heating the steel. He first conducted a series of tests by means of which—varying one factor at a time and keeping all others constant—he determined, to his own satisfaction, that the composition of the bath was responsible for the variations in the hardened steel. He then began to experiment with different compositions of baths. Starting with a simple and commonly used bath, he determined the effect of each ingredient of the bath on steel of identical composition, and then added, one at a time, other chemicals known to be used in heating baths, meanwhile noting and tabulating the changes that the newly added factor brought about.

It was a long drawn-out and tedious process, but it produced remarkable results. In time, a heating bath was found that made it possible to determine in advance the exact dimensional changes in a piece of steel; and to obtain this result, a much less expensive bath than that originally employed was used.

This experience in experimental work is recorded simply to indicate that by a carefully systematized method of research, results can be obtained that far excel the best known practice of today; but the successful research engineer must be willing to use the slow method of arriving at facts by the process of elimination. He does not approach his problem haphazardly, but patiently determines the effect of one factor at a time, until the one thing that he is searching for will stand out clear-cut by itself.

The value of this method of digging out elusive facts has not been sufficiently emphasized in the past. American-trained engineers lean too much toward a hit-and-miss method—short-cut methods which, it must be admitted, have often scored many notable hits, but which also are characterized by a great amount of misdirected and wasted energy.

* * *

How air express saves time and money was demonstrated recently when the power plant of a mine in Colombia broke down. The 387-pound shipment required to make repairs was handled by an air express. This shipment saved the mine three weeks' time and a loss of $2000 a day.

What the Machine Designer Should Know About Motors

An Article that Simplifies the Selection of Motors and Other Electrical Equipment for Machines

By R. S. ELBERTY, General Engineer
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

IN designing a machine to be driven or controlled by means of electrical energy, most designers are handicapped by a lack of specialized knowledge of electrical apparatus. Sufficient information on the use of electric equipment can be obtained, however, without going into the underlying theories by making a study of the results of electrical applications. The purpose of this article is to outline briefly the characteristics of the more common types of electrical apparatus without going into electrical theory. As a rule, a given operation can be accomplished electrically in a number of ways; however, the most advantageous method is not always apparent.

There are Three General Classes of Motors

Motors may be classified according to the type of power required to operate them. They fall normally into three classes—direct-current motors, alternating-current polyphase motors, and alternating-current single-phase motors. Motor characteristics depend somewhat on the class of motor used, but modification of the control equipment may change any given motor characteristic, so that, for most purposes, the three classes may be said to have overlapping characteristics.

The Characteristics of Direct-Current Motors

There are three common types of direct-current motors—shunt-wound, series-wound, and compound-wound motors. Shunt-wound motors have a relatively constant running speed over a wide range of loads. The speed of a series-wound motor, on the other hand, falls off rapidly as the load increases. Series-wound motors have a higher starting torque per unit of current than shunt-wound motors.

Cumulative compound-wound motors can be designed with characteristics ranging between the limits of the shunt- and series-wound motors. Differential compound-wound motors are seldom used. They can be designed to give an increased speed with increasing loads, but they are unstable in operation.

Shunt-wound motors are suitable for most applications. If a higher starting torque is required or a drooping speed torque curve is necessary, a cumulative compound-wound motor can be used, the amount of "compounding" depending on the characteristics required. Both direct- and alternating-current series-wound motors tend to "run away" at light loads. They are generally applied when very high torque is required and when the motors are directly connected to the load. Direct- and alternating-current series-wound motors are used extensively in electric railway work. Sometimes the high speed at light loads characteristic of series-wound motors is useful where small, high-speed motors are required. The "universal" motor is a series-wound motor suitable for operation on either direct or alternating current. It has a large field of application on portable tools, vacuum cleaners, and similar devices.

Direct-current motors have a large field of application where adjustable, variable, or accurate speed control is required. Speed control can be obtained by varying the field of the motor, the armature voltage, or both. This speed control feature makes the direct-current motor the most suitable drive for planers, electric elevators, electric shovels, and similar applications where variable or adjustable speed is required.

Induction and Synchronous Alternating-Current Motors

There are two main classes of alternating-current polyphase motors—induction and synchronous. Induction motors operate on a transfer action and can be designed with a large variety of speed-torque characteristics. They operate at speeds below those of the synchronous motor. Synchronous motors have a direct-current field rotating in step with an alternating-current field. They operate at constant speeds throughout the entire load range. They have inherently high power factors and are often used to make correction for the low power factors of other motors on the system.

Induction motors may have squirrel-cage rotors or specially wound rotors with connections located outside the motor. Squirrel-cage motors may be wound for low starting and reversing torque, suitable for some fans and for reversing applications, such as on laundry washers and dough breaks. A high reactance rotor winding is required. (The term "reactance" means the opposing force of self-inductance to the flow of current.) By increasing rotor resistance or decreasing rotor reactance, more starting torque is obtainable. A wide range of starting torques is available. A high-torque or high-

resistance type of induction motor is used for elevators, punch presses, sheet catchers, and similar applications requiring high starting or reversing torque.

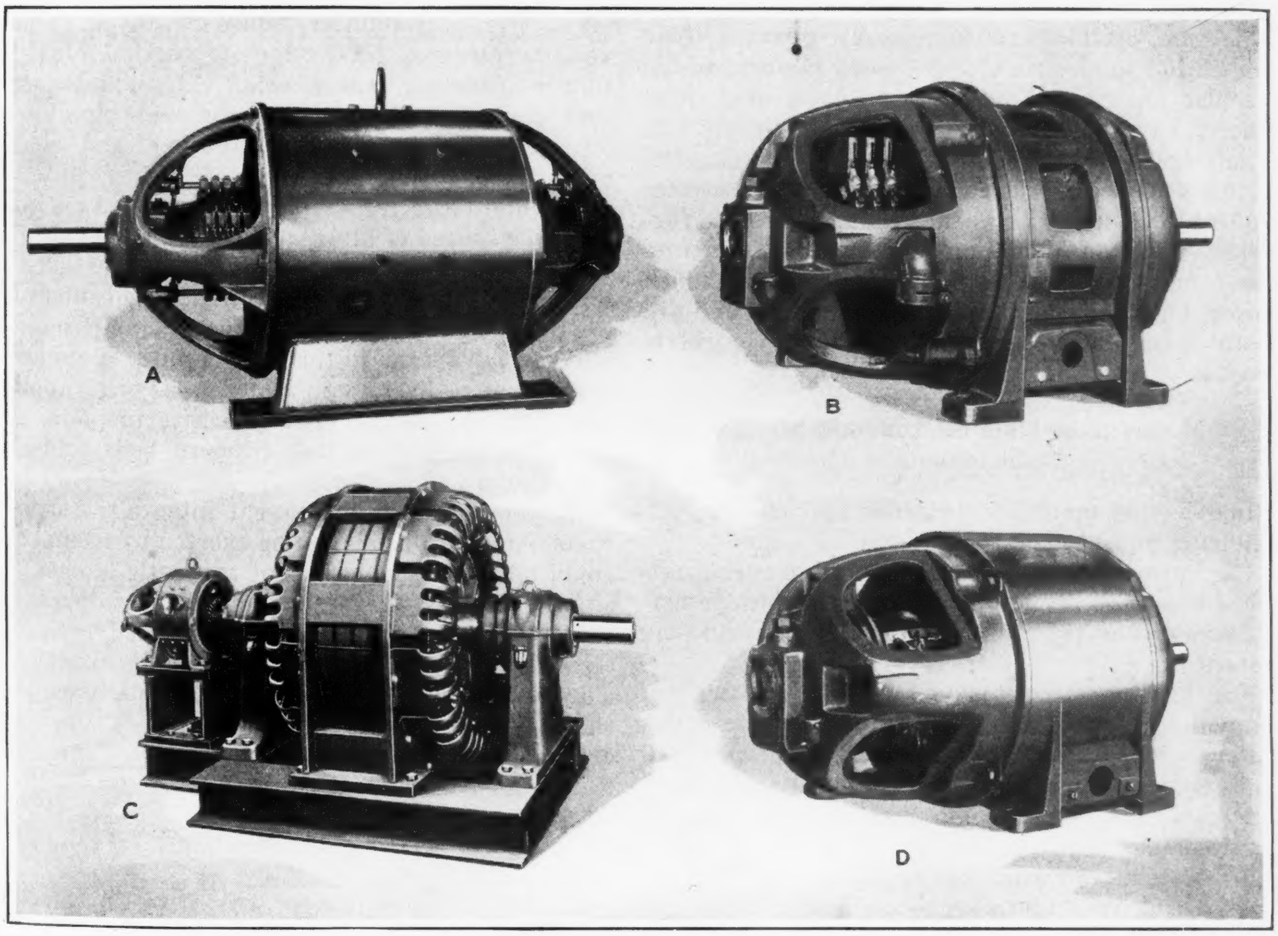
High-frequency induction motors are used in conjunction with frequency changers when very high speeds are desired, as on portable tools or woodworking machinery. These motors have an advantage over the series-wound or "universal" type of high-speed motor in that they operate at a relatively constant speed over the entire load range.

The characteristics of wound-rotor induction motors can be varied by means of a controller in the secondary circuit. These motors are used in heavy-duty starting applications where the losses during starting are dissipated in the external controller rather than in the motor. Starting currents are reduced and an efficient over-all starting characteristic is obtained. Wound-rotor motors are also used for the variable-speed control of machines. At low speeds, the over-all efficiency is low. The design is not economical for large motors operating at reduced speeds.

Induction motors have been made with a number of special windings for operation at more than one speed by merely changing connections to the motor. These motors are not truly adjustable-speed motors, but two or more speeds can be obtained with no great sacrifice of efficiency at low speeds. The correct method of varying the speeds of induction motors is to use a variable-frequency, variable-voltage control—a method used in starting gyroscopes for ship stabilization.

Synchronous motors are not capable of starting heavy loads. However, if it is possible to start them light, they are suitable for driving any load at constant speed. Synchronous motors may be used for "tying in" different units of a machine when definite speed relationships are required and mechanical interlocking would be expensive or impossible. Wound-rotor motors can be connected to operate exactly together—a connection called the "synchronous tie." Such an arrangement has been used with success on vertical-lift bridges, in order to insure that both ends of the bridge will be raised together.

Except for the "universal" or series-wound single-phase motor, single-phase motors have running



(A) A Double-commutator Direct-current Motor Designed Especially for Planer Service. Speed Adjustment over a Wide Range is a Feature. (B) A Wound-rotor Motor and Brake. Low Starting Current, Variable Starting Torque, and Variable Speed are the Advantages. (C) Synchronous Motor. This Type of Motor is Applicable on Slow-speed Drives and when Power Factor Correction is Desirable. (D) Repulsion-induction Single-phase Motor which can be Wound Special to Meet the Requirements of Reversing Service, High Starting Torque, and other Heavy-duty Applications

characteristics similar to the general-purpose type of polyphase squirrel-cage motor. However, various devices are used in connection with these motors to obtain sufficient starting torque. The repulsion-induction single-phase motor starts as a series-wound motor and runs as an induction motor. Other single-phase motors, such as the split-phase motor and the capacitor motor, use a displaced field in one winding, so that they have starting characteristics approaching those of the polyphase motors. There are many other types of single-phase motors, but these four classifications cover practically all single-phase motors in use today.

For applications requiring high starting torque, such as compressors, reciprocating pumps, etc., the repulsion-induction motor is ordinarily used. Special high-torque capacitor motors are also available for heavy-duty starting. For various appliances, universal, split-phase, and capacitor motors are generally used.

Adjustable-speed single-phase motors used for driving fans generally employ some device such as a transformer to obtain various speed torque characteristics. The combined motor, controller, and load furnish an adjustable-speed combination.

Small synchronous single-phase motors have come into prominent use recently through their application to electric clocks. Such motors, which are also used on phonographs, relays, and small timers, have specially designed magnetic circuits which hold the rotors in synchronism when the motors are once accelerated. Some of these motors require to be started by hand, while others are furnished with an induction winding for starting. These motors are not capable of producing much power, but they operate at constant speeds and are useful where accurate timing or speed control is necessary.

Motors to be Used for Different Service Conditions

In selecting motors for various applications, the following general rules may serve as a guide:

For adjustable- or variable-speed control, use (1) direct-current motors; (2) wound-rotor induction motors; or (3) multi-speed alternating-current motors.

For high starting torque, use (1) cumulative compound-wound or series-wound direct-current motors; (2) wound-rotor induction motors; (3) high-torque squirrel-cage motors; (4) repulsion-induction single-phase motors; or (5) special capacitor motors.

For a relatively constant speed with variations in the load, use (1) shunt-wound direct-current motors; (2) general-purpose squirrel-cage motors; or (3) repulsion-induction and split-phase single-phase motors.

For very high speeds, use (1) universal motors; or (2) high-frequency squirrel-cage motors.

When a suitable source of power supply is not available, converting equipment can easily be applied to meet the requirements. For example, a certain manufacturer of unit ventilating equipment ordinarily uses direct-current motors to provide adjustable speeds. In installations where direct current is not available, he furnishes motor-generator sets of sufficient capacity to furnish power for all ventilators in the installation.

Frequency changers are needed with high-speed, high-frequency motors. When variable-voltage speed control is used on direct-current motors, separate generating equipment is ordinarily required.

The Functions of Magnets and Magnetic Devices

Magnets are useful when a force is to be exerted over a short distance or when a vibrating or reciprocating motion is to be obtained. Most magnets have holding properties rather than any great capacity for doing work. Ordinarily, magnets should not be applied when any considerable work is to be done.

Magnets have the additional feature of releasing when the power fails. This is the feature of magnetic brakes which set and lock the controlled machine when the power fails—a valuable advantage on cranes and hoists. This feature is also useful on electric control devices, since it provides for low-voltage release or low-voltage protection. In addition to operating brakes, small valves, and electric control devices, magnets have a wide application on machines for counting, sorting, and similar operations.

To obtain a reciprocating motion with a magnetic device, a source of alternating current or pulsating direct current is necessary. Accessories such as low-frequency generators, rectifiers, and interrupters must be used. Reciprocating magnetic motions have an advantage in that they reduce the number of moving parts to a minimum. Typical applications are electric hammers, electric tampers, concrete form vibrators, hair clippers, bells, and electric razors.

For operation at infrequent intervals, a considerable amount of pull can be exerted by means of a small magnet. In the use of magnetic latches and similar devices, the design should be so arranged that the magnet is energized momentarily. Special circuits are ordinarily used on magnetic chucks and clutches, but such devices must all be designed with the limitations of magnets in mind. A magnet is ordinarily not capable of exerting a strong pull over a long distance.

The Uses of Electrical Impedance

Electrical impedance consists of one or more of three elements—resistance, inductance, and capacitance. Resistance is used for electric light and heat, and as a current limiting means. Inductance or reactance is used as a current limiting means on alternating-current circuits and on special direct-current apparatus where time delay is necessary. Capacitance is used for power factor correction on

alternating-current circuits and as arc extinguishers when high inductive circuits are to be interrupted. Capacitance is also used to start certain types of single-phase motors, to obtain dynamic braking of induction motors, and in conjunction with rectifiers and induction devices in filter circuits where alternating current is converted into direct current.

Heat is formed and power is used when electrical current passes through resistance. This method of producing heat offers the advantage that heat can be concentrated, a valuable feature in electric welding. The heating currents may be induced or they may be conveyed to the heating coil through wires.

The Adaptability of Electronic Devices to Machines

Electron tubes and other electronic devices, as applied in industry, fall into three classes—light sensitive devices, grid-controlled tubes, and rectifier tubes. Light sensitive devices can be used as pyrometers, counters, color sorters, illumination controllers, limit switches, safety guards, etc. Grid-controlled tubes are used as amplifiers when currents are too small to be handled by mechanical relays. The use of electron tubes outside the radio and talking picture industry is still in its infancy; many future developments may be expected.

Finishing Lathe Work with Abrasive Cloth

By WILLIAM S. ROWELL

In a large machine shop with which the writer was acquainted nearly forty years ago, it was against the rules for a lathe man, outside the toolroom, to have any kind of file. Nevertheless, most of the men had at least one file concealed some place about their machines. It is the writer's opinion that the file is too much in evidence today. With anything better than a completely worn out lathe, a finish "free from tool and file marks" can be obtained more quickly and better by the use of abrasive cloth.

If size limits are moderate, the finishing cut does not need to be extra smooth. A coarser grade of abrasive may then be used, especially at the start. If the limit is less than plus or minus 0.001 inch, 0.0005 inch to 0.001 inch is about the correct amount to remove with the abrasive cloth. The proper grade to use on various softer materials must usually be found by experiment, but for steel, when the limit is close, grade 120 is good for a start.

If a high polish is wanted, a finer abrasive can be used subsequently to give the desired results. As such use of abrasive cloth is really a grinding process, surface speeds should be high. Five thousand feet per minute does no harm, but plenty of oil should be used. By using plenty of oil and constantly shifting the position of the abrasive cloth, it is possible to apply a very high pressure.

A narrow piece of board or other piece of wood of the proper shape and long enough to be used as a lever serves as a good applicator. A tool in the lathe toolpost makes an excellent fulcrum over which to operate the wood lever. If the work is not frail, one need not be afraid to apply considerable pressure. Men who have only used the hand to apply dry abrasive cloth to the work have never learned what such finishing material can easily be made to do. When enough plain cylindrical work of nearly the same diameter is to be handled, it sometimes pays to make one of the well-known polishing clamps. A small board or other piece of wood of appropriate size, however, answers very well and may be used on a variety of surface forms. The abrasive cloth should be torn lengthwise of the warp into strips about twice the width of the applicator and folded to once its width. This provides a rough side to grip the applicator.

The lathe work should be fairly smooth, depending on the required final finish. The microscopic feed often used is almost never necessary. With the high-speed steel tools of today, the desired finish-cut smoothness is best obtained by removing from 0.005 to 0.010 inch on the diameter at a high speed, with a moderate feed, the tool nose being flat enough to leave no appreciable feed mark.

* * *

Sharpening Drill to Cut Clean-Edged Holes in Sheet Metal

By DANIEL L. MATHER

Grinding a drill to the shape shown in the illustration, with the lip under-cut as at *A*, is an improvement on the method of grinding a drill for thin sheet metal described in September MACHINERY. The under-cut *A* can be ground with a sharp-cornered wheel.

With a drill sharpened in this manner, holes can easily be spaced within 0.003 inch of the specified dimensions. The point of the drill must enter the center-punch mark in the work before the outer lips begin to cut. The lips of the drill should be thinned at the point, and the center-punch mark should be made light. Care must be taken to see that the drill runs true.

Drill Ground to Cut Holes in Thin Sheet Metal

Notes and Comment on Engineering Topics

An entirely new heating flame, known as the "diffusion" flame, to be used for heating metal preparatory to forging, was described at a convention of the American Gas Association by Henry O. Loebell, vice-president of the Combustion Utilities Co., New York City. With the new method, alternate layers of gas and air slowly flow through the furnace. Combustion takes place only at the zones where air and gas meet.

In operation, an unburned gas blanket flows over the heated steel, preventing it from forming scale. In this way, considerable savings in forging costs will be made. Scale causes the surface of steel to pit and reduces the life of shaping and forming dies. It is also claimed that the diffusion flame makes it possible to heat to a forging temperature at much greater speed than formerly.

Several of the large bus and truck manufacturers have recently adopted Stellited exhaust valve seats, because thorough road tests have shown that after runs of 100,000 to 150,000 miles, no regrinding or refinishing of the valves is necessary and the seating surfaces are in as good condition as when installed. One prominent manufacturer has standardized on this type of exhaust valve seat in all his six-cylinder engines, because hard-faced seats have been found to last longer, require less attention, reduce valve grinding and adjustments to a minimum, conserve fuel, and maintain the efficiency of the motor.

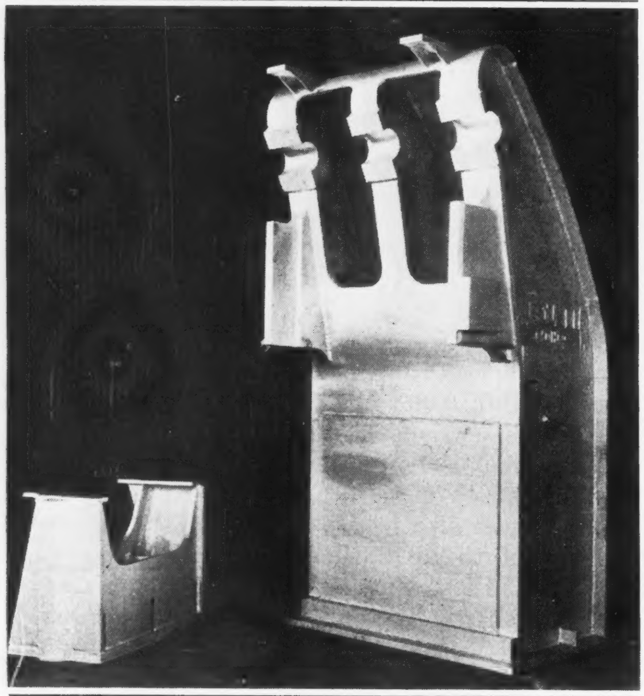
When motors are operated continuously at full load, it is conservatively estimated that ordinary cast-iron seats have to be reground every 10,000 miles. The fact that Stellited valve inserts will operate for from ten to fifteen times this mileage without regrinding indicates that such seats will outlast the life of most passenger car motors.

The most powerful X-ray tube so far utilized in practical industrial service is rated at 300,000 volts and is designed for the X-ray inspection of fusion welds.

The speed of power boats up to 50 feet long can be almost doubled with no increase in the power of the driving engine if two narrow planes are attached to the hull of the boat, says Dr. Oskar G. Tietjens, Westinghouse research engineer. These planes, shaped like the wings of an airplane, will have a tendency to lift the boat almost entirely out of the water, thus eliminating much of the frictional resistance of the water.

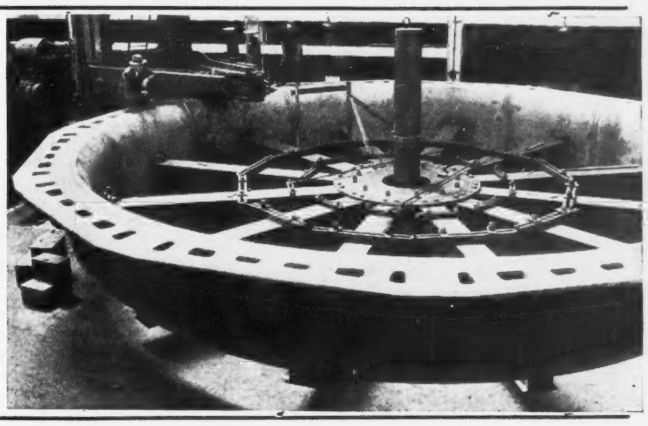
Two out of the ordinary installations of soil-heating cable have been made by Cleveland industries, according to General Electric engineers. The cable, which is made of nickel-chromium wire covered with asbestos, taped with varnished cambric, and encased in a lead sheath for protection from moisture, was designed for horticultural uses, but it has industrial applications as well.

A steel plant had difficulty in the winter time with its lubricant for roll-neck bearings, which



Frame and Slide for a 185-ton Marquette Horning Press Built in Welded-steel Construction by Lukenweld, Inc. The Frame is over Eleven Feet High and Six Feet Wide

Facing off the Throat Liners of the Huge Boulder Dam Penstocks at the Plant of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This Large Steel Casting Weighs 40 Tons and is 36 Feet Outside Diameter



congealed in the pipe lines. Formerly a steam pipe or air duct was nested with the pipe lines; now soil-heating cable has been wound around the pipes and insulation applied. An automatic, adjustable thermostat maintains the temperature of the lubricant at the proper point, irrespective of the weather conditions.

Another installation is in a paint plant laboratory, where soil-heating cable has been installed in a water bath which is used to maintain constant humidity for testing paints in a saturated atmosphere. There, also, an automatic, adjustable thermostat is employed to insure the required amount of heat.

In a paper read before a meeting of the International Acetylene Association, George C. Comstock, mechanical engineer with the Bethlehem Steel Corporation, Steelton, Pa., referred to the billet and slab gouging process developed and patented by the Sparrows Point plant of the Bethlehem Steel Corporation as being one of the most recent and outstanding developments in the use of oxy-acetylene in steel plant operation. This process replaces the usual chipping out of surface defects, and results in a saving of about $1.75 a ton over the old method.

At Schenectady, N. Y., a half mile of highway has been illuminated with sodium vapor lamps, under the joint sponsorship of the General Electric Co. and the New York Power and Light Corporation. The demonstration is the result of many years of research by General Electric physicists and engineers in Schenectady, Cleveland, and Hoboken, as well as thorough studies of similar developments abroad. Sodium light is monochromatic, or of one color, whereas daylight is made up of all colors. Monochromatic light is valuable in highway lighting, being especially useful in revealing the details of objects at low levels of illumination, although it has disadvantages in interior lighting, where color discrimination is important. The monochromatic light of sodium falls in a region near the maximum sensitivity of the eye. The experimental set-up will determine whether this visual sharpness is an important factor in night driving.

An item in *Industrial Britain* calls attention to a device that makes gear-changing on motor buses unnecessary. The device is built by Leyland Motors of Lancashire, England. A bus provided with this device is remarkably silent, smooth-running, and easy to control. The device is said to consist of a hydraulic turbine placed in the position usually occupied by the gear-box. The bus is controlled by means of the conventional accelerator pedal, brakes, and a hand-lever for engaging the direct drive when a speed of about fifteen miles an hour is reached.

A valuable advantage of graphite lubrication from the operating standpoint, as referred to by the Acheson Oildag Co., is its peculiarity of maintaining operation for a long time after the oil supply has been cut off without allowing overheating or wear in the bearing. This fact has been confirmed by exhaustive experiments. It is explained by the circumstance that the coefficient of friction of steel on colloidal graphite is not much greater than that of fluid friction, and a roughening of the graphite-coated surface on a smooth shaft is not to be feared even when the pressure is very high.

The automotive industry is the largest purchaser of gasoline, rubber, alloy steel and malleable iron, mohair, upholstery leather, lubricating oil, plate glass, nickel, and lead of any industry in the country. Of the national production of rubber, the automobile industry uses 80 per cent; of plate glass, 38 per cent; of steel and iron, 15 per cent; of hard wood, 14 per cent; of aluminum, 25 per cent; of nickel, 28 per cent; of copper, 11 per cent; of lead, 10 per cent; and of lubricants, 59 per cent.

EDITORIAL COMMENT

The Application of a Common-Sense Rule Becomes News

If an industrial enterprise is to preserve its capital, it must systematically replace obsolete equipment with new. When depreciation is merely charged off on the books, and no effort is made to replace manufacturing facilities to an amount equivalent to the depreciation, then the plant is truly "depreciating." Some day it will be next to worthless, particularly if no provision has been made to set aside, from earnings, a reserve equivalent to the depreciation, for then there will be no funds with which to replace the old equipment. Actually, the original capital has been dissipated—sometimes by selling at such low prices that the capital has, in effect, been given away to the company's customers; sometimes by paying it out in dividends. In either case, the company faces a serious situation and must either enlist new capital or quit.

Comparatively few concerns handle the depreciation account as they should. Hence, when a concern is found that follows a definite policy in this respect, its practice is so outstanding that what it does is real news. There is a large machinery manufacturing company employing nearly a thousand men that, for years, has followed the policy of depreciating its machinery equipment by 10 per cent annually, and the following year *buying and installing new equipment to a value equal to the depreciation charged off the previous year*. This means that, on an average, the equipment in this plant is renewed every ten years. The result of this practice is that the plant referred to is one of the best equipped machinery plants in the country.

If all, or, at least, a large number of the manufacturing concerns in this country followed this policy, our whole industrial structure would be on a different plane. We would not have the severe ups and downs in the so-called "capital goods" industries that we have, for there would be a fairly constant demand for machinery and equipment of all kinds. It would not be a case of a rush to buy when times are good and a complete let-up in equipment buying in quieter periods; and, as a result, there would be neither the extreme booms nor the quiet periods that we now deplore. In these times, it is not possible to over-emphasize the importance of a policy (obvious though it may be) that is so essential in maintaining a firm business structure. Most of our troubles are due to the fact that we ignore the obvious common-sense rules of good financial management. The few concerns who do observe these rules are to be commended and congratulated.

Let Us Concentrate on the Advantages Rather Than on the Defects

In the working out of the national industrial program, many difficulties are inevitably met with. Some of the measures taken by the Government are justly subject to criticism. Some mistakes will be made and some confusion will arise.

So far, however, the evidence is to the effect that the benefits are greater than the disadvantages. The commercial and industrial conditions of the country at the present time are undoubtedly better than they would have been if nothing had been done.

It seems to be human nature to magnify difficulties and seize upon some minor detail that may be criticized, instead of focussing attention upon the major problem and the manner in which it is being worked out. The new departure in industrial management upon which the nation has engaged will be still more successful if we are able to see and appreciate the benefits to be derived from concerted action, rather than to permit ourselves to dwell overmuch upon the defects that must inevitably crop out here and there during the working out of the program.

No machine was ever perfect as first designed. It is experimented with, changed, and modified until it works in a satisfactory manner. If the designer saw only the defects and not the ultimate result, he would become discouraged and the machine would never be perfected. Fortunately, his imagination has created a picture of the final result to be achieved, and he keeps that picture steadily in his mind during the experimental period until the perfected machine is produced.

We must do the same during this period of experimentation with our new conception of industrial organization. If we do, we shall ultimately create an industrial machine that will surpass our past experience and efforts.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Rapid Return Movement Obtained by Roller Clutch and Crank Arrangement

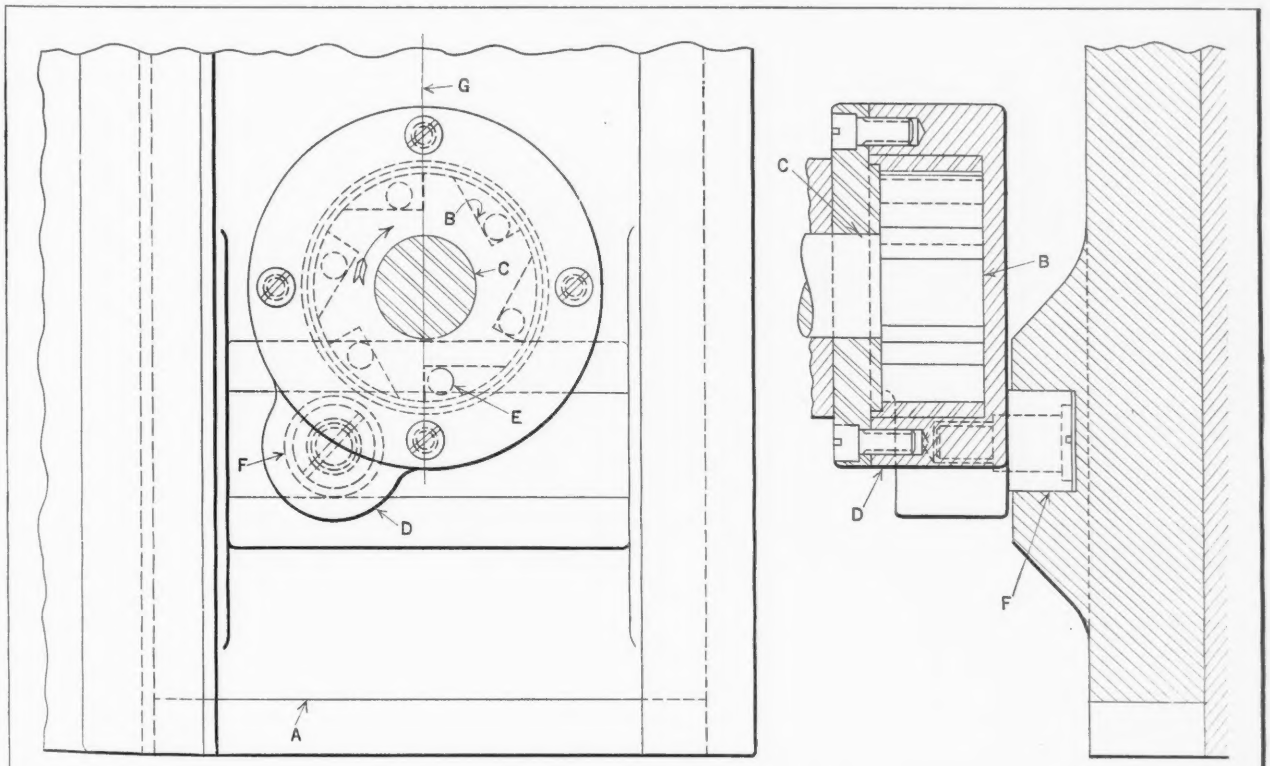
By J. E. FENNO

In designing machinery, it is frequently possible to make use of a roller friction clutch for reducing the time consumed during the idle part of the production cycle. This application is exemplified by the simple crank motion of the Scotch yoke type shown in the illustration. It is employed for actuating a slow-moving slide in a machine for forming plastic materials.

The slide indicated at *A* is reciprocated vertically. Instead of being a single piece, the crank is composed of the core *B*, integral with drive shaft *C;* the member *D*, which is bored to provide a running fit for the core; and the rollers *E*. The roller *F* on the stud that is secured in the projection on member *D* serves as the crankpin and engages a slot extending across the slide.

As the crank rotates in the direction of the arrow, the slide is given its upward or working stroke, the movement being comparatively slow. During this stroke, the weight of the slide causes the rollers *E* to grip both the core and the member *D* tightly, so that both members rotate positively together. When the roll *F* has passed the center line *G*, the weight of the slide, which has caused the rolls to wedge tightly on the upward stroke, releases the gripping pressure of the rolls between the core and member *D* and allows the latter to rotate one-half revolution, returning the slide to its lowest position at a relatively higher velocity.

The downward stroke is the idle one, and its velocity in this particular case is unimportant in so far as the timing of the slide movements is concerned. This condition made it possible to use this crank. At the bottom of the stroke, the rolls *E* once more pick up the motion and move the slide upward at the slow speed required for the operation. It is estimated that with this design, an ap-



Crank-operated Slide with Quick-return Movement

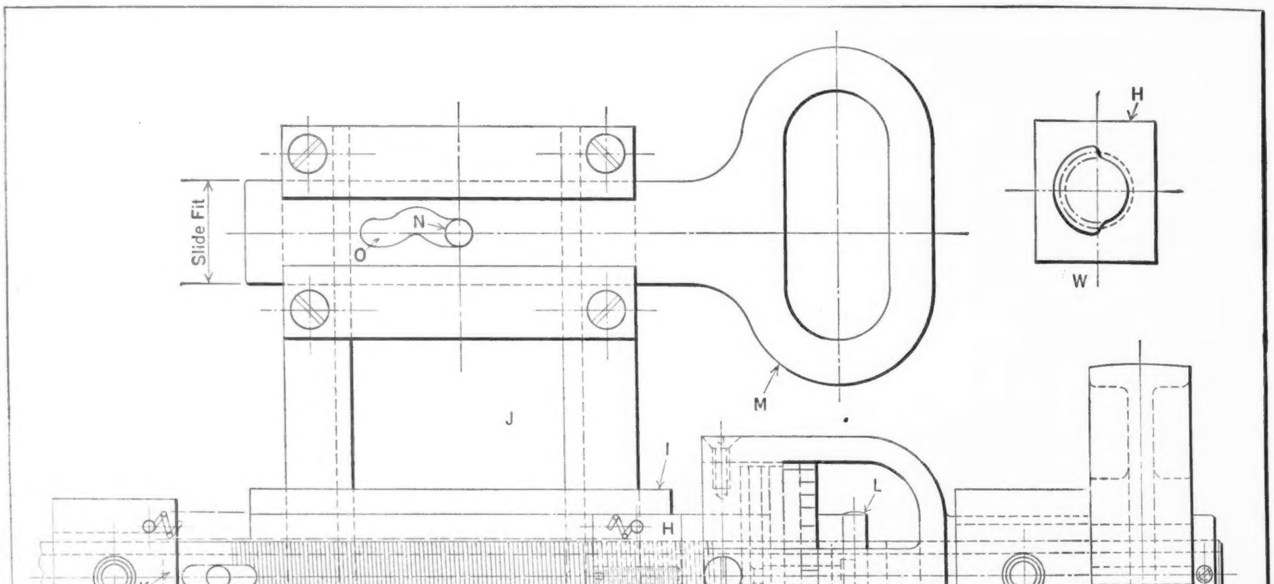
proximate gain of 30 per cent in production time is obtained over the time that would be required if a crank of the solid type were used.

Mechanism for Stopping a Machine After a Given Number of Revolutions

By C. W. HINMAN

The mechanism shown in the accompanying illustration is designed for use on either a hand- or a power-driven machine. The object of the device is to control the number of pieces fed into an assembly from a magazine, by automatically stopping the machine at the end of the count. The device is applicable to any kind of machine in which a shaft or the complete machine is required to be stopped after a given number of revolutions. The machine or shaft remains idle until the work is removed and the handle *M* is moved to the starting position. The mechanism illustrated is an improvement on the writer's original design previously developed and used to count out and deposit a given number of core laminations in an assembly fixture.

The pulley *A* drives the main tubular shaft *B* through clutch members *E*, *F*, and *G*. Shaft *B*, in turn, drives the machine. Pulley *A* is keyed to the hub of clutch spider *E*, as shown. The circular barrel *F*, having thirty internal teeth, is positively secured within the four arms of spider *E* and re-



Mechanism with a Lead-screw and Nut Arranged to Disconnect the Driving Clutch after a Given Number of Revolutions

volves with pulley A. The connecting and disconnecting circular clutch member G between B and F has thirty external teeth designed to mesh with the teeth in F at P. Member G is a sliding fit on shaft B, but is prevented from rotating on it by key R.

The concentric spring-pad ring S, mounted on three sliding pins U, is backed up by three compression springs T. On the face of this pad is riveted a piece of brake lining or fabric which provides a frictional engagement between F and G. This friction clutch is adjusted to allow two revolutions before the speeds of the two revolving members become synchronized and the teeth become positively engaged at P.

Within the shaft B is a sliding rod K having crosswise holes near each end, through which two pins L are driven. These pins project through slots in the sides of the shaft. Shaft B has either a buttress or a square thread with a lead and a horizontal length that is sufficient to provide for the largest number of revolutions required. The half-nut H is a sliding fit in the channel I, mounted on the slide J. The threaded hole in nut H is elongated on one side an amount equal to a little more than double the depth of the thread. The thread is also cut away until only about one-half of the threaded circumference is left for engagement, as shown in the separate view W.

The pin N in the cross-slide actuates the transfer channel I, either engaging the half-nut H with the lead-screw or disengaging it, by its action on the cam slot O in the sliding portion of handle M. Two coil tension springs Q are attached to the half-nut, their opposite ends being positively fixed to the left-hand bearing on the machine. The half-nut is shown just making contact with the front of clutch member G. As shaft B continues to revolve, the nut advances until the clutch teeth at P are disengaged. The member G then comes in contact with pin L as both G and K are moved forward, disconnecting the clutch pad S from frictional contact with F. The machine is thus stopped, allowing the clutch barrel to run idle.

When it is desired to start the machine, the handle M is pulled forward, causing the nut to become momentarily disengaged from the lead-screw, so that it returns instantly to its left-hand position, and is in mesh again with the lead-screw thread. On its return movement, nut H strikes the pin L at the left and causes the friction pad S to engage F. This, in turn, causes G to rotate in synchronism with E, so that the teeth at P are engaged by means of rod K and pins L. This starts the machine, and the nut begins to travel on the lead-screw toward the clutch, where it repeats the stopping operation. Cam slot O is designed to lock the nut channel in its proper position while the nut is traveling on the lead-screw.

When the nut is disengaged from the lead-screw by handle M, it is returned by springs Q and caused to strike pin L at the left, thus being held momentarily in contact with the pin. The nut cannot start back until it has caused the clutch to engage and thus commence the count. The springs T under the pad S act as buffers against the sudden return impact of the nut on pin L, and allow the clutch to engage more smoothly. Screws at the back of the compression springs T provide means for adjusting the spring pad to give the proper synchronizing friction and buffer action.

Screw V in the half-nut is adjusted to give the exact number of revolutions required. Any desired number of revolutions within the range of the lead-screw can be obtained by using a split washer of the right thickness on the contacting face of nut H or by screwing pins of the required length into the face of the nut.

For a large number of revolutions in which the length of the lead-screw would obviously be too long, if arranged as illustrated, the nut can be operated on an independent screw in a channel at one side of the clutch, using speed reducing gears between it and shaft B. In this case, the nut is made wide enough to surround shaft B and long enough to lead properly in its guiding channel. However, with a lead-screw 12 inches long, having 18 threads per inch cut on shaft B, over 200 shaft revolutions can be obtained before the clutch is disengaged. This is sufficient for most counting and machine stopping operations.

* * *

Finding Area of Irregular Surface

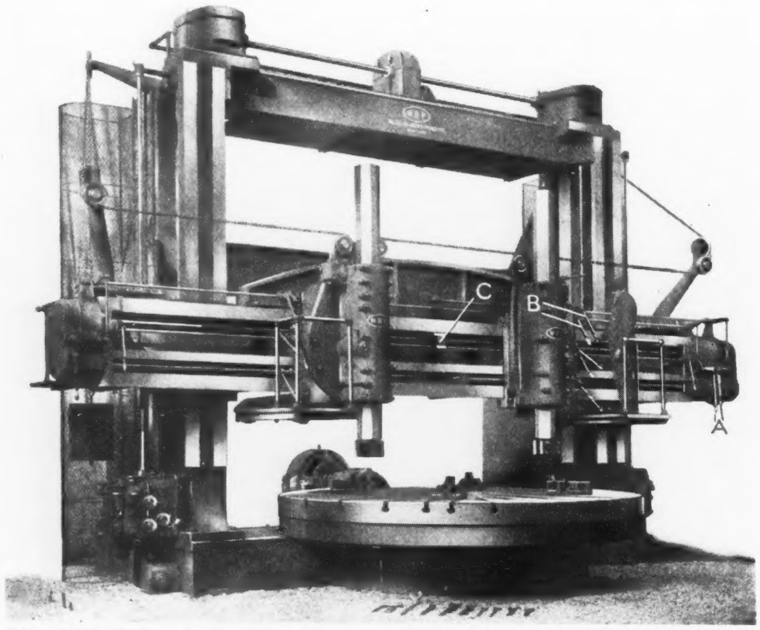
By P. F. ROSSMANN

When a planimeter is not part of the drafting-room equipment, and when the cross-section paper method is not practicable, the areas of irregular figures can be found in the following simple manner: A piece of cardboard, 10 by 10 inches, with an area of 100 square inches, is accurately weighed, preferably on a chemist's balance. The cardboard must be of uniform thickness. The irregular figure is then traced on the cardboard, after which the traced portion is cut out and accurately weighed.

Obviously, the weight of the cut-out portion is to the weight of the uncut cardboard as the area of the irregular shaped piece is to the area of the uncut sheet.

* * *

One of our great national weaknesses is speculation. Everybody recognizes that fact in the stock market orgy of our late boom days. Only a few realize the extent to which speculation in land is the source of many troubles of the farmer, the part it has played in loading banks and insurance companies with frozen assets, and compelling the closing of thousands of banks; nor how the high rents, the unpayable mortgages, and the slums of the cities are connected with speculation in land values.—*Dr. John Dewey in Commerce and Finance*



Taper Turning on Turning and Boring Mills

Methods Employed to Increase the Range of Tapers Cut on Standard and Specially Equipped Turning and Boring Mills

Fig. 1. Niles Vertical Boring and Turning Mill with the Right-hand Head Equipped for Turning Tapers

Many boring mills are purchased without regard to future taper turning requirements. Consequently, the builders of such machines receive many requests for information relative to machining tapers that cannot be cut on a standard machine. It is the object of this article to describe various methods of cutting tapers on turning and boring machines, including the use of different taper turning attachments.

Standard boring and turning mills of the type having two heads on the cross-rail have no provision for taper cutting other than the swiveling of the boring-bars to angular positions. As the bar feed operates at whatever angle the bar is set, it is possible to obtain any taper up to the maximum angular adjustment of the boring-bar, which is 30 degrees from the vertical on some machines and 45 degrees on others.

Increasing Taper Turning Range by Using Bar and Saddle Feeds Simultaneously

A larger range of tapers can be obtained by the simultaneous use of the bar and saddle feeds, with the bar set to different angles. Standard boring mills, however, are built with one lever on the end of the cross-rail which selects either the bar or saddle feed, and it is therefore impossible to have both feeds engaged at the same time. When occasional tapers requiring a wider range of adjustment are to be cut, the selecting lever can be disconnected and both feed clutches can be engaged by hand.

If a large amount of taper work is necessary, a boring mill can be purchased with individual levers for the bar and saddle feeds to either or both of the heads. Fig. 1 shows a machine with individual levers for the right-hand head. These levers are indicated at A, and owing to the size of the machine, are duplicated on the head at B for the convenience of the operator.

When the bar and saddle feeds are used at the same time, the feeds are equal, as the feed-box common to both gives equal bar and saddle feeds for each position of the feed-change levers. As the bar and saddle feeds are reversed at the same time by the same lever, the direction of each will have a fixed relation to the other. Usually, the saddle feed is from the center of the table outward for both heads when the bar feed is downward.

Determining Angular Setting of Boring-Bar

The diagrams Figs. 7 and 8 show the method of determining the angle to which the boring-bar on the right-hand head should be set to take a cut at a given angle with the table when the bar and saddle feeds are used simultaneously. The bar is swiveled to the right of the vertical in Fig. 7, and to the left in Fig. 8. The line AB in Fig. 7, at an angle of x degrees with the vertical line EE, represents the direction and amount of the bar feed. The horizontal line AC, equal to AB, represents the direction and amount of the saddle feed for an equal period of time.

The diagonal AD of the rhombus $ABDC$ obtained by drawing CD and BD parallel to AB and AC, respectively, is the resultant direction of the tool on the boring-bar, and the angle ADB is the horizontal angle of the taper. As the angles ADB, ADC, DAB, and DAC are equal, they are represented by angle a. It is evident from the diagram that

$$x = 90 \text{ degrees} - 2a \qquad (1)$$

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on Vertical Boring Mills

By
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Sales Engineer
Brandes Machinery Co.
Cleveland, Ohio

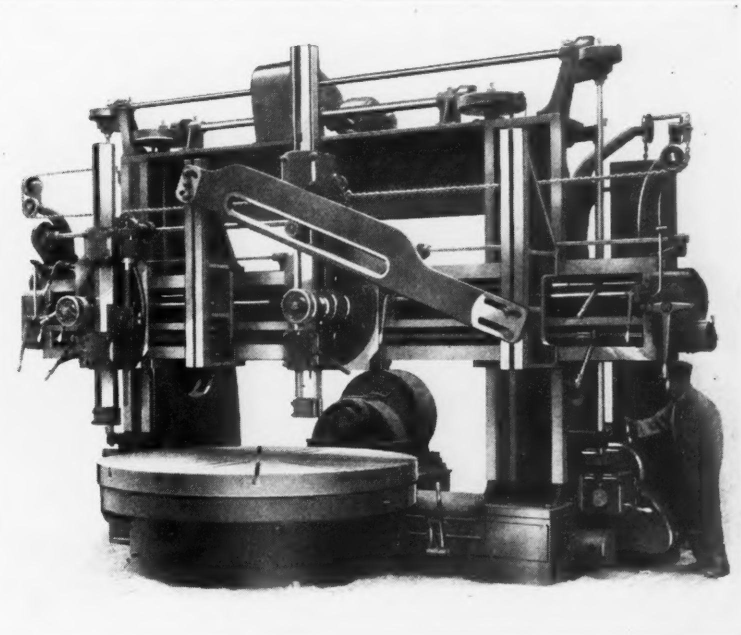


Fig. 2. Guide Bar Applied to Niles Vertical Boring and Turning Machine for Use in Turning Tapers

With the same notations in Fig. 8, we find that in this case

$$x = 2a - 90 \text{ degrees} \qquad (2)$$

The bar is set to an angle from the vertical equal to the difference between 90 degrees and twice the required horizontal angle. When twice the required horizontal angle is less than 90 degrees, the bar is set to the right, and when twice the angle is greater than 90 degrees, the bar is set to the left.

When tapers are being cut with the left-hand head, the diagrams in Figs. 7 and 8 should be drawn in reversed positions, as the bar will be swiveled in the opposite direction, but the same formulas will apply. The accompanying table gives the range of horizontal angles obtained by the above methods on two machines with different maximum swivel angles for the bars. Special taper attachments are built to cut tapers having smaller horizontal angles than those obtained by the methods described.

Guide Bar Attachment for Taper Cutting

An attachment that is occasionally used consists of a guide bar attached to brackets on the cross-rail. As the saddle is fed along the cross-rail with the bar feed disengaged, the boring-bar is guided vertically by means of a block or roller fastened to the front face of the boring-bar. The block or roller fits into a slot in the guide bar. Figs. 2 and 9 show the attachment applied to Niles and Betts machines.

When a number of definite tapers are required, a special attachment is built into the bar feed mechanism by means of which the amount of bar feed is varied with respect to the saddle feed, and then with both feeds engaged and the bar vertical, the tool will follow a tapered path, the horizontal angle of which will have for its tangent the ratio of bar feed to saddle feed. This attachment consists of a swing arm built into the bar feed mechanism, on which gears of the proper ratio are mounted to obtain the required bar feed. A set of change-gears is furnished for each taper to be cut.

While the tapers to be cut with this type of attachment are always figured with the bar feed vertical, it is evident that if the bar is swiveled from one extreme angular position to the other, a range of tapers can be obtained for each set of change-gears furnished with the attachment. The diagram Fig. 3 shows the relation between the angle of the bar and the horizontal angle of the taper for the right-hand head. The line a represents the amount and direction of the bar feed at an angle x degrees from the vertical, and the horizontal line b represents the amount and direction of the saddle feed for an equal period of time.

The tool will follow the resultant line c, giving a taper having a horizontal angle A. The lengths of the lines a and b are equal to the amount of bar and saddle feed, respectively, required to obtain a taper having a horizontal angle Q, when the bar feeds vertically. Or, referring to the small right triangle, Fig. 3, drawn to a smaller scale:

$$\frac{a}{b} = \tan Q$$

Since

$$\text{Sin } B = \frac{b \sin A}{a}$$

and

$$\frac{b}{a} = \cot Q$$

we have:

$$\text{Sin } B = \sin A \cot Q \qquad (3)$$

A study of the diagram will show that

$$x = 90 \text{ degrees} - (A + B) \qquad (4)$$

When $A + B$ is greater than 90 degrees, the bar should be swiveled to the left of the vertical, as shown in Fig. 6, and in this case,

$$x = (A + B) - 90 \text{ degrees} \qquad (5)$$

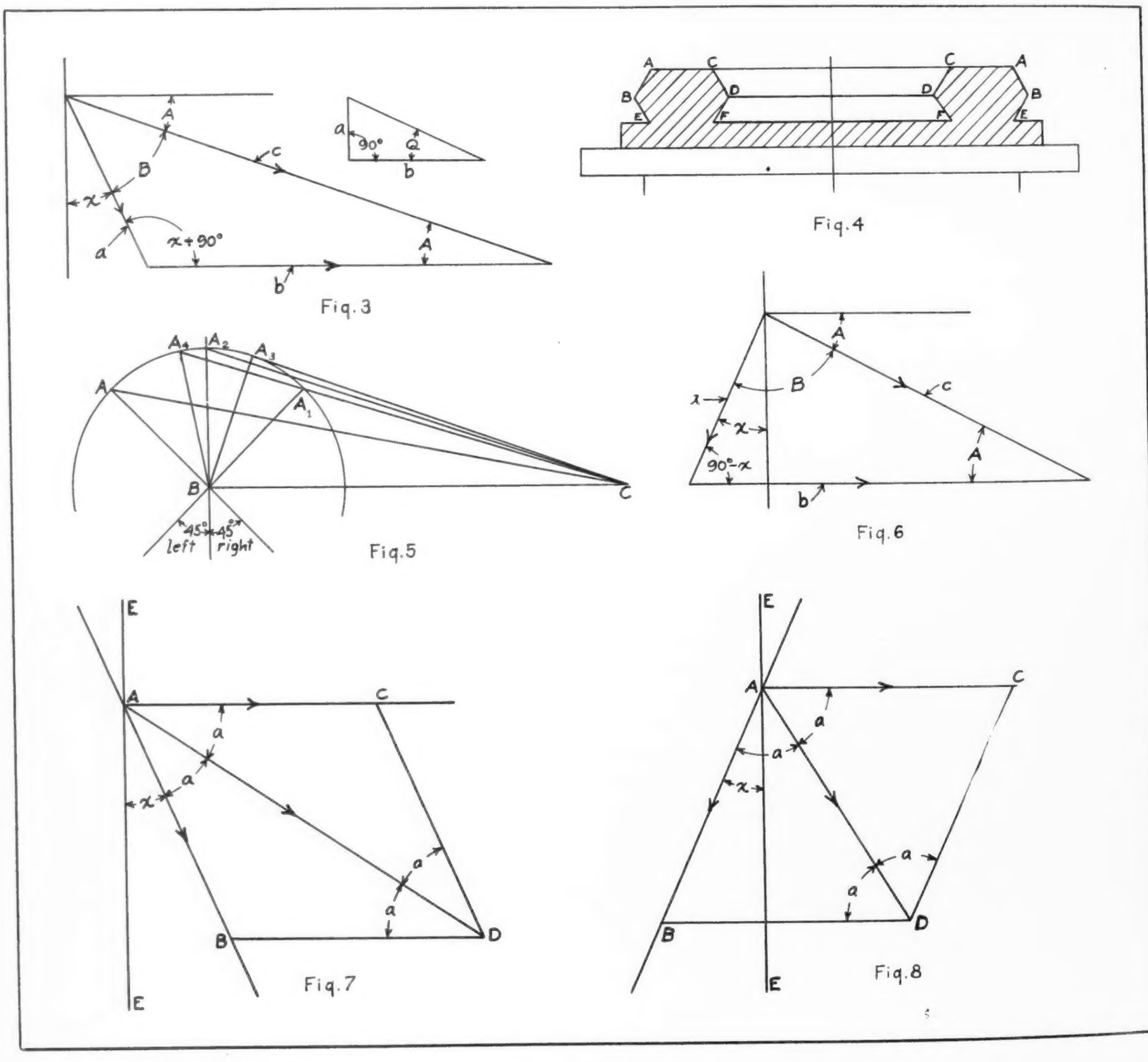
The diagrams should be drawn to the opposite hand when the attachment is applied to the left-hand head, but the same formulas are applicable.

Fig. 5 permits us to study the range of tapers that can be obtained for each set of change-gears. An arc with a radius AB equal to the bar feed is drawn from B. The horizontal line BC is drawn equal in length to the saddle feed. Suppose the bar can be swiveled 45 degrees each side of the vertical. The lines AB and A_1B represent the bar feed in these extreme positions. The angle ACB is the minimum horizontal angle, and as the line AB is moved to its vertical position A_2B, this angle will increase until it is equal to Q, Fig. 3, and angle A_2BC is equal to 90 degrees.

As the line AB is moved to the other side of the vertical, the horizontal angle will increase slightly until the position A_3B is reached, when its value will be a maximum, the angle BA_3C will be a right angle, and the line A_3C will be tangent to the arc. As the line AB is moved farther to the

Range of Horizontal Taper Angles Machineable on Vertical Turning and Boring Machines

Maximum Swivel Angle of Bars on Machine, Degrees	Bar Feed with Bar Swiveled to Left or Right on Either Head, Degrees	Both Feeds with Bar Swiveled to Left on Right-hand Head or Right on Left-hand Head, Degrees	Both Feeds with Bar Swiveled to Right on Right-hand Head or Left on Left-hand Head, Degrees
30	90 to 60	60 to 45	45 to 30
45	90 to 45	67 1/2 to 45	45 to 22 1/2



Figs. 3 to 8. Diagrams Used in Illustrating and Describing Different Methods of Turning Tapers on Vertical Boring and Turning Mills

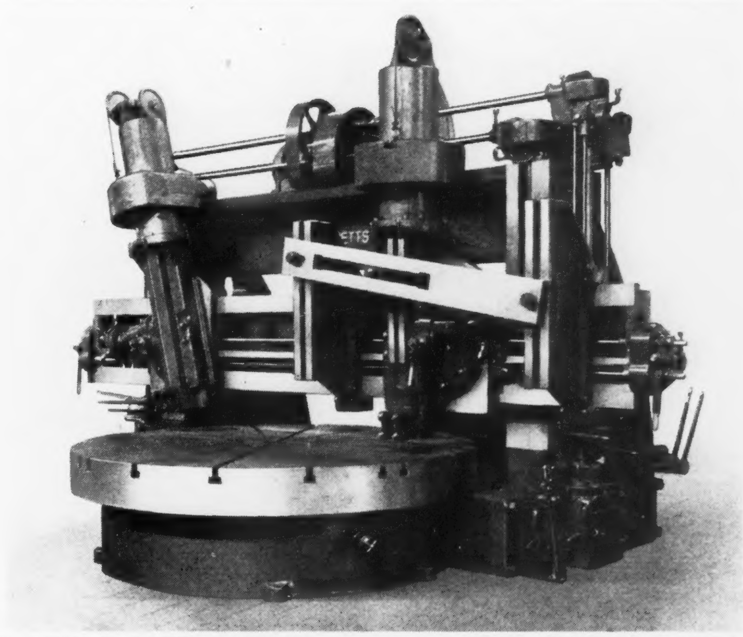


Fig. 9. Taper Turning Attachment Applied to Betts Vertical Boring and Turning Machine

other side of the vertical, the horizontal angle will decrease until the extreme position is reached at A_1B.

By extending the line A_1C until it intersects the arc at A_4, it is evident when AB is between A_1B and A_4B that it has two positions for each horizontal angle except when it is in the position A_3B. It is also evident that the maximum value of the horizontal angle is not much greater than the value obtained when the bar is vertical. Also, any angular movement of the bar when near the position A_3B will make very little difference in the horizontal angle. These conditions are more noticeable when the value of the horizontal angle Q (Fig. 3) is small.

When it is desirable to find the minimum angle A, Fig. 3, that can be obtained with the bar swiveled to its maximum angle and the change-gears on the machine set to give an angle Q with the bar vertical, the following formula can be used:

$$\text{Tan } A = \frac{\tan Q \sin (x + 90 \text{ degrees})}{1 - \tan Q \cos (x + 90 \text{ degrees})} \quad (6)$$

In using this formula, it must be remembered that the cosine of an angle between 90 degrees and 270 degrees is negative.

The maximum angle A that can be obtained is found by the formula,

$$\text{Sin } A = \tan Q \quad (7)$$

Formula (6) is derived from the standard oblique triangle formula, using tan Q in place of a and b.

Formula (7) is derived from Formula (3) by substituting 1 for the value of sin B, as B is equal to 90 degrees when the value of A is maximum.

Any horizontal angle between the minimum and maximum values obtained from Formulas (6) and (7) can be found, the required angle of the bar being figured from Formulas (3), (4), and (5). In addition to finding the minimum angle A, Formula (6) can also be used to find A for any value of x in Fig. 3. To find A for any value of x in Fig. 6, Formula (6) should be changed to read:

$$\text{Tan } A = \frac{\tan Q \sin (90 \text{ degrees} - x)}{1 - \tan Q \cos (90 \text{ degrees} - x)} \quad (8)$$

Fig. 10 shows a Colburn machine, with single lever control for feed and traverse, arranged to cut a taper with the left-hand head having a horizontal angle of 7 degrees 59 minutes. Simultaneous feeds are obtained by driving the bar feed-rod from the saddle feed-screw with reduction gears on the end of the cross-rail. The bar feed is thus varied relative to the saddle feed and the required taper is cut with the bar vertical. The bar can be swiveled 45 degrees, giving a range of horizontal angles, according to Formulas (6) and (7), between 5 degrees 10 minutes and 8 degrees 3 minutes with the same reduction gears. With the right-hand bar swiveled 8 degrees 37 minutes from the vertical, a horizontal angle of 81 degrees 23 minutes is cut with the bar feed.

Fig. 4 is a sectional view of a part having both convex and concave tapers.

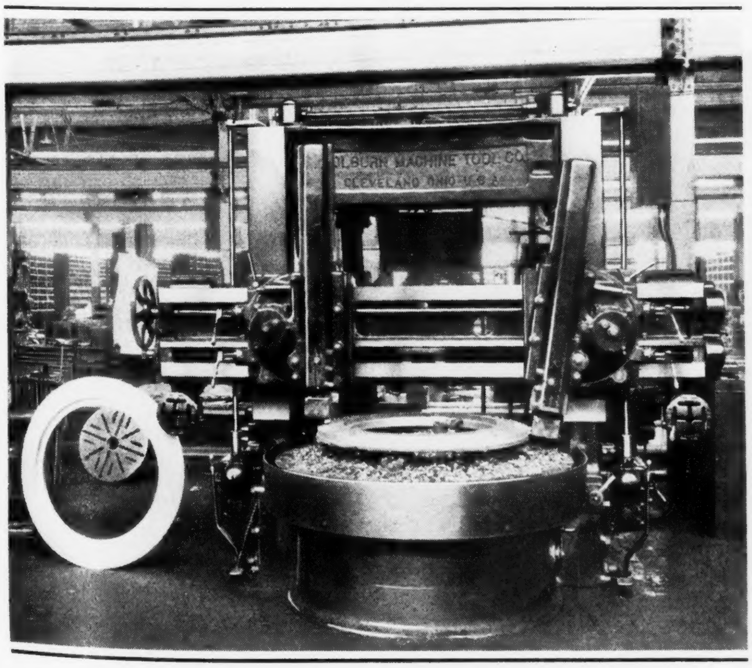


Fig. 10. Colburn Vertical Boring and Turning Mill Equipped for Taper Turning

Most of the preceding calculations were made for convex tapers, as illustrated by the lines *AB* and *DF*. Concave tapers are illustrated by the lines *CD* and *BE*. The terms convex and concave are used without strict adherence to their literal meaning. As all boring-bars can be swiveled an equal amount both sides of the vertical, concave tapers of the same range as convex tapers can be obtained by the individual use of the bar feed with the bar swiveled from the vertical.

When bar and saddle feeds are used simultaneously, concave tapers cannot be cut without the addition of a reversing mechanism in either the bar or saddle feed. When a taper attachment with change-gears is used, the direction of the bar feed can be reversed by the addition of an idler in the train of gears giving the proper relation between the direction of the feeds to obtain concave tapers. A taper attachment similar to that shown in Figs. 2 and 9 will cut both concave and convex tapers, as the guide bar can be set in both directions from the horizontal.

On standard boring mills, the bar and saddle feeds to the right-hand head are entirely independent of the feeds to the left-hand head, but the bar-feed spline rods in the cross-rail are in line with each other and have a common bearing at the center (see *C*, Fig. 1). By making a change in this bearing and providing means for coupling the ends of the two rods together, a middle western manufacturer is able to obtain a large range of tapers with either head on a standard machine. When tapers are being cut with the right-hand head, the right-hand feed-box provides the saddle feed, while the bar feed is obtained from the left-hand feed-box by means of the coupling. With this arrangement, the different combinations of feeds from the two boxes will give a large number of tapers with the bar vertical, and the range can be increased by swiveling the bar, as shown in Figs. 3 and 6 for each combination.

Tapers can be cut by the left-hand head with the saddle feed from the left-hand feed-box and the bar feed from the right-hand box through the coupling. As each feed-box has a reverse, it is possible to obtain the proper direction of the feeds to cut both concave and convex tapers with either head. The diagrams Figs. 3 and 6 are applicable to the cutting of convex tapers with the right-hand head or concave tapers with the left-hand head.

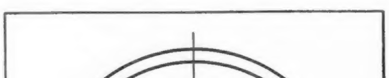
When convex tapers are to be cut with the left-hand head or concave tapers with the right-hand head, the figures should be drawn to the opposite hand. When the two feed-rods are coupled together, extreme care must be taken not to engage both bar feeds at the same time. Also, when the coupling is being used on a machine that has no means on the heads for disengaging the bar feed, care must be taken to set the bar on the head not in use so that it will not over-travel or interfere with the work, as it is necessary to have this bar feed the same amount as the bar in use.

The diagrams are also useful in obtaining the proper amount of feed per revolution of the table when the tapered surface is being cut. This amount will be larger or smaller than that obtained from the feed-box, according to whether the resultant line is longer or shorter than the line representing the saddle feed. Side-heads on boring mills have seldom been furnished with taper attachments. Guide-bar and change-gear attachments, however, can easily be applied, and if the bar can be swiveled, it is also possible to obtain a range of tapers by the simultaneous use of both feeds.

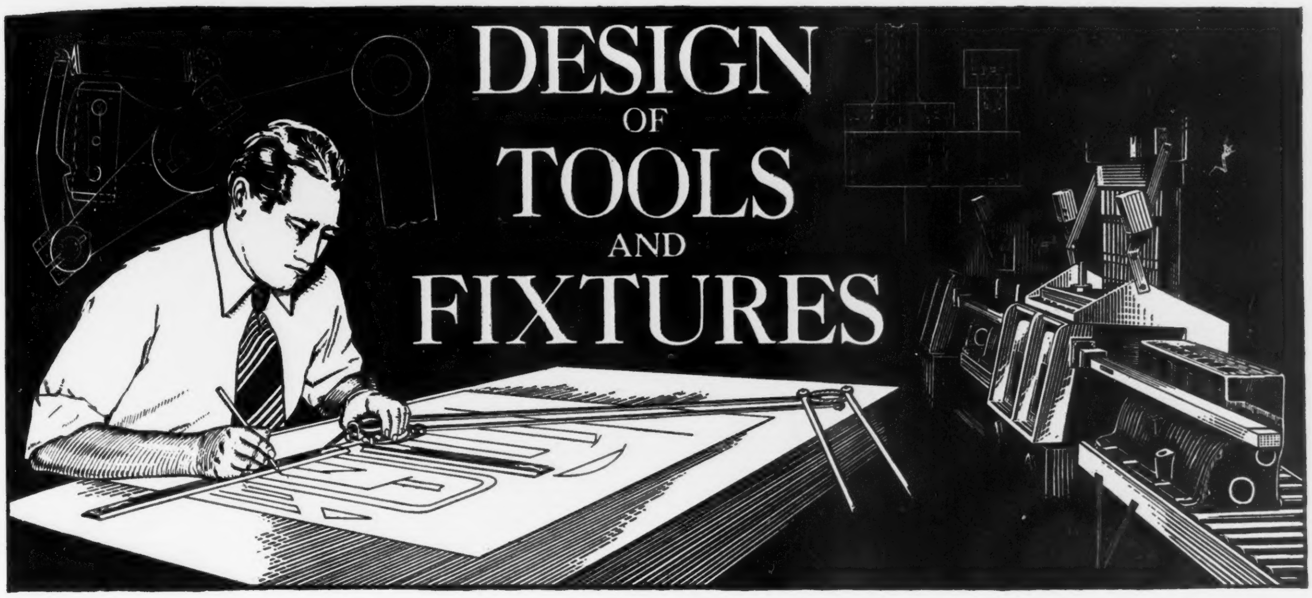
* * *

The False Doctrine of Curtailed Production

The American Society of Mechanical Engineers must discourage the present movement to replace machine processes by hand labor. During recent months an effort has been made to decry capital expenditures, to urge the substitution of human labor for mechanical power and machinery, and to hinder economical methods of production. The present will not be improved and the future will be greatly impoverished if this type of thinking prevails. Surely, we cannot have too many or too effective devices for relieving men from drudgery or for supplying human beings with more comforts. It may be recalled that during the years of greatest prosperity, millions of people, even in this most favored land, lacked many of the material comforts which are essential for well-being and happiness. We are far from the saturation point in our need to utilize science and engineering.—*A. A. Potter, Dean of Engineering, Purdue University, and Past-President of the A. S. M. E.*



An Ash Tray Made from Flat Stock in a Single Die at One Stroke of the Press, Including Blanking. Output, 60 Ash Trays per Minute. The Method Used and the Design of the Die Employed will be Illustrated in April MACHINERY.



Special Equipment for Tapered Keyway Broaching

By F. SERVER

The broaching of tapered work offers an opportunity for the display of ingenuity in tool design. Fig. 1 shows an arrangement for broaching the keyways in small gears having tapered holes, while Fig. 2 illustrates an improvement in the work locating and holding member. Referring to Fig. 1, *A* indicates a broach-holder of the pull type having a threaded portion *B* that is secured to the head of the broaching machine for the purpose of drawing four broaches *C* through four gears *D*. In the lower right-hand corner of the illustration is a small broken section view through the broaches. The broaches *C* are cut away at *E* so that they hook over the flange of the pull bushing *B*, four screws in ring *F* serving to clamp the broaches in place.

The work-holding plate *G* is supported in the broaching machine as shown, suitable slots being provided for broach clearance. These plates carry four studs, of which the two designated *H* are alike, while the two studs *J* are the same, except that keys are mounted therein, as indicated. In order to have the four broaches travel in a straight line, the work is located at an angle, so that the edge of the hole nearest the center of the broaching unit will be parallel with the center line of the unit. The studs are machined by using a double pair of centers. The slots through the bushings guide the broaches on the sides, and back up the edges opposite the cutting teeth.

As two keyways, spaced 90 degrees apart, are to be cut in each gear, the unit was made with two plain plugs *H* on which the work could be mounted in any radial position. In addition, two studs *J* were provided having keys in them that enter the keyways previously broached for locating purposes while the remaining keyways are broached.

The normal operation of this device is quite simple. The machine is stopped with the tool-head *A* at the extreme left after broaching keyways in the

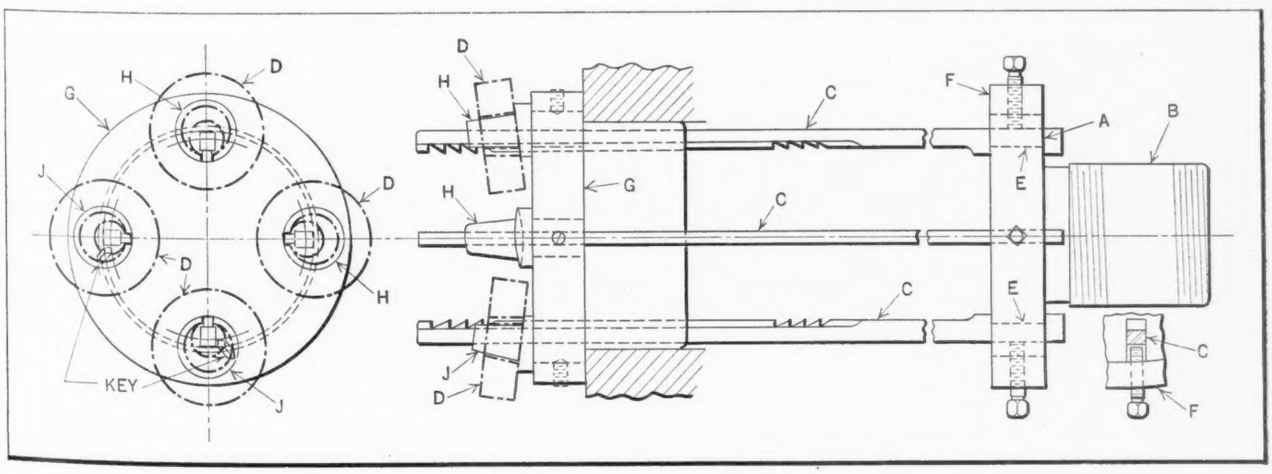


Fig. 1. Arrangement for Broaching Keyways in Four Gears at One Time

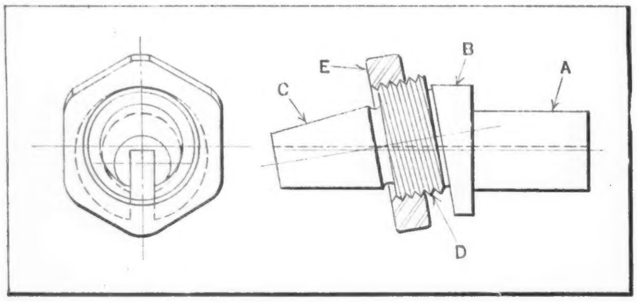


Fig. 2. Improved Work-holding Stud with Nut E for Use in Removing Broached Piece

two gears located on plugs *H*. The two broached gears are then located on the studs *J* by the locating keys, and two unbroached gears are placed on plugs *H*. The machine now broaches the four keyways simultaneously. Thus two gears with two keyways are completed at each traverse of the broaching head from left to right.

While the arrangement shown usually operates very satisfactorily, some difficulty was experienced from the work jamming tight on the taper of the studs *H* and *J*, particularly if the hole was small and the work did not pull against the shoulder of the studs. It was necessary in such cases to work a screwdriver in from behind and force the gears off the studs. To facilitate the removal of these gears, the type of stud shown in Fig. 2 was adopted.

In this construction, the shank *A*, Fig. 2, enters the work-holder *G*, Fig. 1, while shoulder *B*, Fig. 2, takes the thrust of cutting. The tapered end *C* and the threaded portion *D* are machined at a suitable angle for broaching, while collar *E* is used to back up the work against the broaching cut and also to force the work off the tapered end, the hexagon on the collar being provided for use with a thin wrench.

Jig with Self-Contained Coolant Arrangement

By J. E. FENNO, Belleville, N. J.

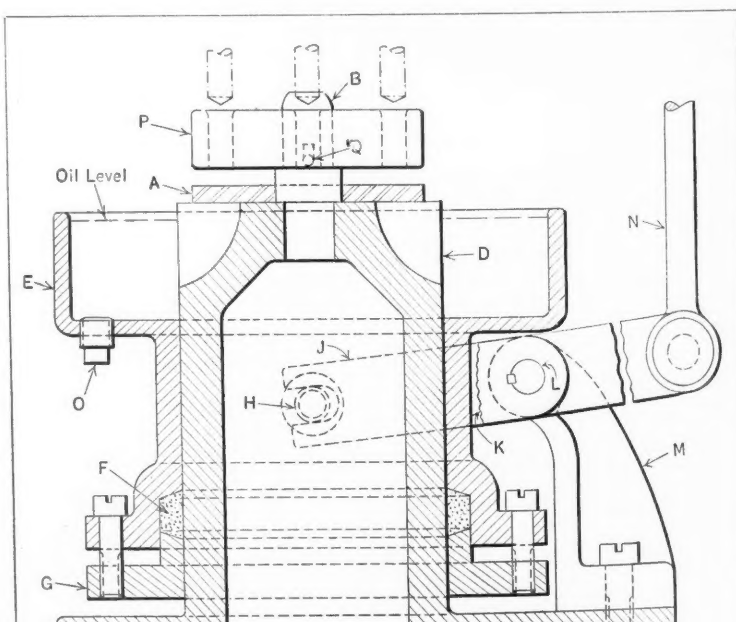
Many of the drilling machines in the smaller plants are not equipped with systems for delivering cutting lubricant to the drills. Hence, when a lubricant is required, an ordinary oil-can or a drip-can must serve the purpose. Besides being ineffective, this method usually results in dirty working conditions, due to the oil finding its way over the jig, tools, and machine.

These unsatisfactory conditions are avoided in one plant by incorporating within the jig itself, where possible, an arrangement for automatically submerging the work in oil just before the drills begin to cut. The work is kept submerged until the holes are drilled; and as the drill saddle is elevated, the oil chamber automatically recedes from the work, allowing the latter to drain off before it is removed from the jig. A jig of this type, used on a multiple drilling machine, is shown in the illustration.

The work *A* is a circular wearing or thrust plate for a centrifugal pump rotor, in which four bolt holes are required to be drilled. This plate is made of tough armor steel, and to drill it successfully, a copious supply of cutting lubricant is essential. The work is located by the center plug *B*, secured in the base *D*. The base is fastened to the machine table and is a slip fit in the oil chamber *E*. To prevent leakage of the oil between the base and oil chamber, the packing *F*, held in place by the gland *G*, is provided.

Two trunnion pins *H*, screwed tightly in the sides of the oil chamber, engage the slots in levers *J* and *K*. Both of these levers are keyed to the shaft *L*, which is pivoted in the bracket *M*. Lever *J*, however, has an extension connected to the link *N*, and the upper end of this link is connected to the drilling machine saddle. Drain plug *O* permits the oil to be drained before the oil chamber is cleaned out.

In the position shown, the drills are about to enter the guide plate *P*, located on the base by the pin *Q*. As the drills approach the work, the saddle descends with link *N*. This movement of the link causes the levers *J* and *K* to swing, imparting a vertical upward movement to the oil chamber. When the points of the drills reach the work, the latter will be completely submerged in the rising chamber of oil and will remain submerged until the drills pass through the work. The saddle is then



Jig Equipped with an Oil Chamber which Rises Automatically and Submerges the Work while Drilling

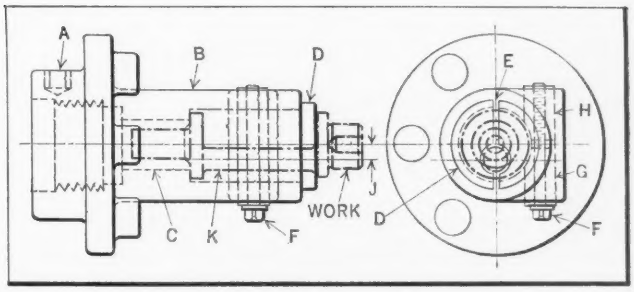
elevated, causing link N and levers J and K to impart a downward movement to the oil chamber; and when the chamber has assumed the position shown, the work has time to drain slightly before its removal from the jig.

Lathe Fixture for Turning and Drilling Eccentric Parts

The fixture shown in the accompanying illustration is used for turning and drilling the concentric ends of short rods that have an eccentric portion at the center, as indicated by the dot-and-dash outline. The work is located by the eccentric portion K, which has been previously machined. The entire fixture is attached to the spindle nose of the lathe in the usual manner, there being a hardened steel bushing at A for the rod used to screw the chuck on or off the spindle nose.

This fixture has very few parts. It consists primarily of the casting B, made with a clearance hole at C and an eccentric bushing D, which is the principal unit. This bushing is split at E into two parts which fit around the eccentric portion K of the work, to which it is clamped by means of a screw F and a pair of clamping collars G and H. The amount of eccentricity J is obtained by boring a hole off center in the bushing. All other boring operations performed in the fixture are concentric.

To put the work in place, bushing D is removed and the two half-members are placed over the eccentric portion of the work. The work and bushing are then inserted in the fixture and clamped by screw F. By reversing the work in the bushing, the opposite end can be turned, and by using split bushings having different amounts of eccentricity, other work of a similar kind can be machined. F. H. M.



Lathe Fixture with Split Adapter Bushing for Holding and Locating Work by Eccentric Portion

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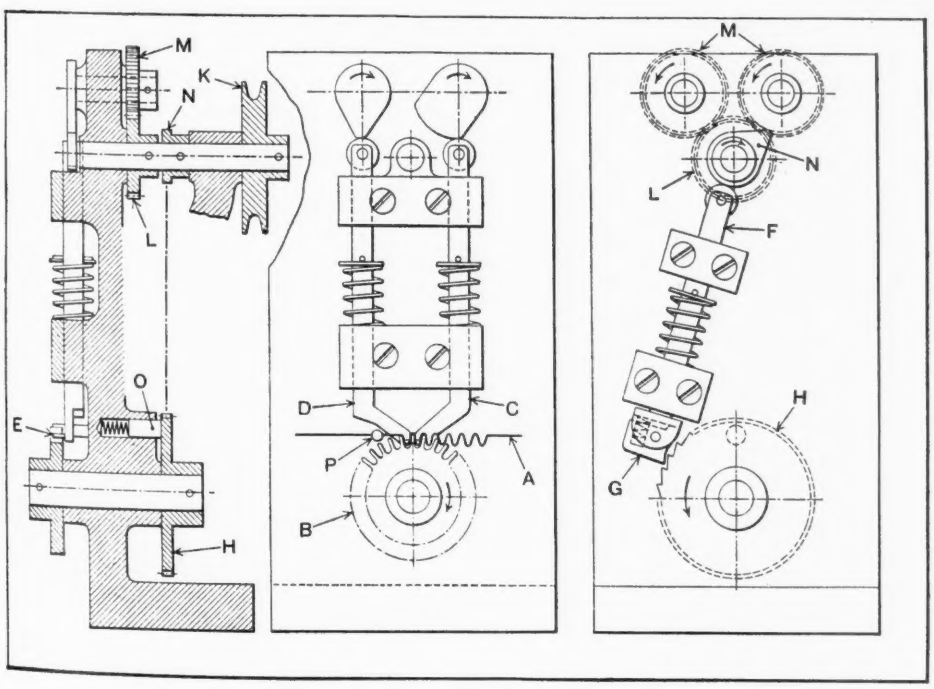
Automatic Wire-Crimping Machine

In some electrical resistance units, the wire is "waved" or "crimped" instead of being wound. One method of doing this is by means of the automatic machine shown in the illustration. Here, the wire in the process of being crimped is indicated at A. It is fed from a reel (not shown) at the left through the guide post P and over the die B. Teeth are cut in the periphery of the die to correspond with the depressions to be formed in the wire which is forced between these teeth by the pin E, secured in the cam-operated slide D. However, before this pin comes in contact with the wire, a similar pin in another cam-operated slide C enters and dwells in the last depression formed. The cams actuating the slides are timed to obtain the action described.

With this arrangement, as each new depression is formed, the wire stock can be drawn only from the left. While pin E is forcing the wire between the die teeth, it is obvious that the pin in slide C will serve to prevent the depression already formed from being distorted.

After a depression is formed and slides D and C have reached the top of their strokes, another cam N at the rear of the machine imparts a downward movement to the slide F. This movement causes the pawl G on the slide to rotate the ratchet H, fastened to the die shaft, and move the die around one tooth. As the die rotates, the stock is carried along into position for forming



Automatic Wire-crimping Machine in which a Die of the Rotary Type is Employed

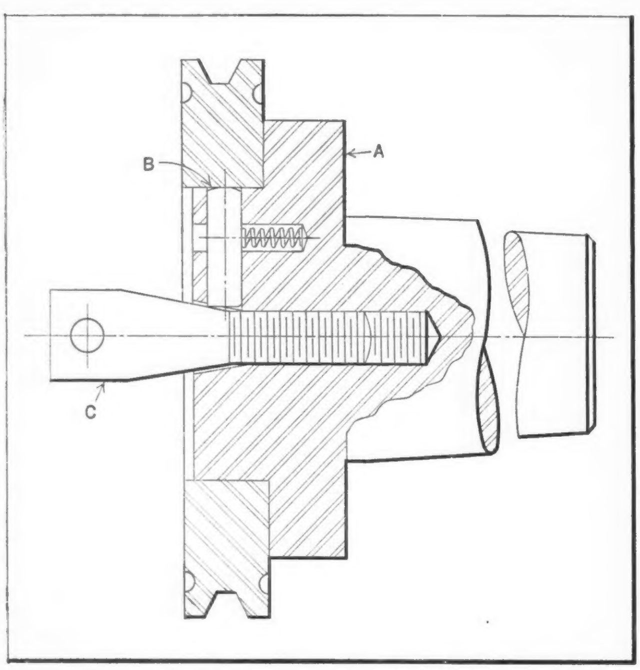
another depression in the wire. All the movements of the machine members are actuated by the three cams, which, in turn, are rotated through the gears M and L by a belt on the pulley K. The pulley rotates at about 120 revolutions per minute. To insure accurate indexing of the die, a spring-actuated plunger O is provided. This plunger serves as a brake and eliminates any overlapping movement of the die due to its inertia. B. R.

Inexpensive Ring Chuck of Quick-Action Type

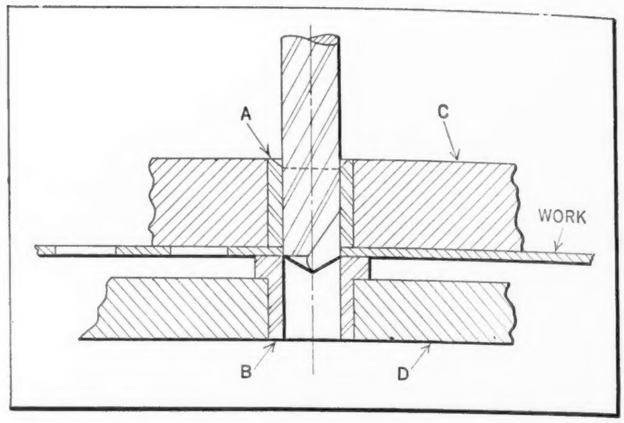
By HENRY W. MASS, Rochester, N. Y.

When several ring-shaped parts are to be turned and faced in a lathe, this work can be greatly facilitated, at little additional expense, by using a rapid-action chuck like that shown in the illustration. As indicated, this chuck is used for facing one side of a grooved pulley and cutting the three grooves without disturbing the setting.

The chuck consists essentially of the body A, which has a tapered shank to fit the lathe spindle. The projecting end of the body is turned down to a diameter slightly less than that of the pulley bore. Three equally spaced pins B are forced radially against the pulley bore by the tapered plug C, thus centralizing the work and clamping it securely in position for the turning and grooving operation. For very light work, the outer end of plug C may be knurled, but for heavier work, a hole should be drilled through this end for a lever pin. Coil springs behind each pin B prevent the pins from dropping out of the chuck when the work is removed.



Inexpensive Lathe Chuck with Quick-action Feature for Holding Rings while being Faced and Grooved



Jig for Drilling Smooth Holes in Sheet Metal

Drilling Holes Rapidly in Sheet Metal

By C. F. STAPLES, Birmingham, Mich.

It is sometimes desirable to drill holes having smooth edges, without burrs, through thin sheet metal. The accompanying illustration shows equipment used on a drill press for this work. The drill bushing A guides the drill, while bushing B supports the work and holds it in a flat, level position. The drill bushing is chamfered in the usual way and has the customary drill clearance. The supporting bushing B, however, is not chamfered, has no drill clearance, and is ground flat on the top.

When the bushing B becomes worn through contact with the drill, it is reground to maintain a sharp edge at the top end of the hole. The inside diameter of this supporting bushing is ground to the same diameter as the drill. The drill is ground to standard size and shape, and the spindle stop is set to allow the drill to just come in contact with the bushing B. This setting serves to remove any burrs that may be formed and provides clean straight holes.

When high production is required, the feed can be operated by a foot-pedal connected to the press handle, a spring being used to return the spindle to the starting position so that both of the operator's hands are left free to feed the stock. The cutting time is so short that the drill can be run at a very high speed. If suitable work stops are provided, an operator can drill from twenty to one hundred holes a minute in strip stock.

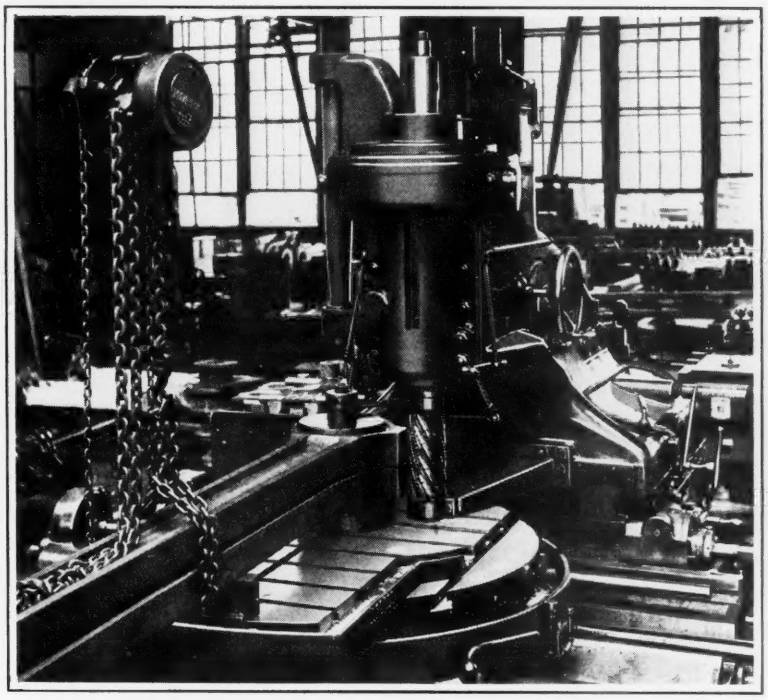
* * *

If the engineer is to be an important figure in public affairs he must acquire a broader technique than that which he ordinarily possesses, and he must inform himself concerning a wide range of subjects of which ordinarily he knows little. Furthermore he must acquire a wide knowledge of economic history and be able to trace the effect of economic changes over long periods of time.—*Dexter S. Kimball, Dean of the College of Engineering, Cornell University*

Milling the Ends of Locomotive Connecting-Rods

Irregular contours on the ends of locomotive side-rods, eccentric crank-arms, radius-bars, and other parts are finished in the Stratford, Ontario, shops of the Canadian National Railways by the use of the vertical milling machine shown in the accompanying illustration. In this illustration, the large ends of two main-rods are shown being milled simultaneously by a helical fluted cutter 15 inches long. The diameter of the cutter is about 5 inches.

Work of this kind comes to the milling machine with the contour previously roughed out by means of oxy-acetylene cutting equipment. Thus, but a minimum amount of stock need be removed by milling. Only one cut is taken, about 1/2 inch of stock being removed.



Milling the Ends of Two Locomotive Main-rods Simultaneously to the Required Contour

The outer ends of the rods are supported by a hoist mounted on an overhead arm. This arm swivels with the table as the cutter follows the contour of the rod. The table has both rotary and lengthwise movements, while the cutter-head is movable in a crosswise direction. This combination of movements allows the cutter to finish the forgings to any desired outline. Using high-speed steel cutters of the design shown eight main-rods can usually be finished at both ends between regrinds.

C. O. H.

* * *

Many of industry's present difficulties have been caused by manufacturers who have engaged in a competitive race to build the "largest factory of its kind in the world." The result is over-sized buildings, over-equipment, over-production, under-pricing, and, all too often, deficits instead of profits. Drives to secure sufficient orders to keep the over-expanded factory busy or to "absorb the overhead," have made volume loom larger than profits. The expenses created by management's folly have no place in prices to be paid by the customers.—*Robert Scudder Denham*

Electrically Heated Lubricant Testing Machine

The Timken Roller Bearing Co. of Canton, Ohio, has developed a machine that will accurately determine the load-carrying capacity of lubricants. Essentially, this machine consists of a cast-iron base supporting a testing mandrel, a tank containing the lubricant, and a lever system for applying load or friction. Three General Electric cartridge-type heating units keep the lubricant at any desired temperature from ambient up to 210 degrees F. The equipment is simple in design and is so easily operated that the operator needs no special training or skill to obtain accurate results.

The machine, as stated, is designed to test the load-carrying capacity or film strength of lubricants, particularly those beyond the range of viscous lubrication, and hence is adapted to testing "extreme pressure" lubricants. Tests can be made to show accurately comparative load-carrying capacities of lubricants at constant rubbing speeds, and the maximum load a lubricant will stand before the film breaks down. These tests can be made with reference to any typical operating condition as regards load, speed, or temperature.

The testing machine, although primarily designed for checking the load-carrying capacity and friction of lubricants, has been modified to check the wear developed by any abrasive quality in the lubricant under investigation. Certain types of compounded lubricants have been found to be quite abrasive, and the amount of wear taking place during a test can be easily checked by weighing the specimen before and after the test to determine the amount of material that has been removed.

* * *

There are, in the United States, 36,500 car and truck dealers, and over 98,000 garages, service stations, and repair shops. About 317,000 gasoline filling stations supply the motorists' needs for oil and gasoline.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

O. E.—We need a low-expansion alloy for use in equipment where it is necessary that the expansion be known accurately and remain constant, and would appreciate answers to the following questions: (1) Does the coefficient of thermal expansion of the nickel-alloy Invar vary with age, heat-treatment, or cold-working? (2) How could the expansion coefficient at room temperature be determined in a piece of Invar that is to be incorporated in a machine? (3) Is it practicable to roll sheets of Invar into tubing?

Answered by "Nickel Steel Topics," International Nickel Co., Inc., New York City

1. The coefficient of expansion of Invar does vary with heat-treatment and cold-working. It does not vary with age, but the 36 per cent alloy may change minutely in length at constant temperature. This effect is so slight as to be negligible for all practical purposes.

2. The expansion of Invar at room temperatures is so small as to be undetectable except with the most delicate apparatus. We know of no way to determine it directly upon a machine part. It would be necessary to make tests in the type of apparatus described by Scott in his paper in Vol. 13 of the Transactions of the American Society for Steel Treating, page 829 (1928). Not knowing the size of the part to which you refer, we do not know whether it would be feasible to construct such an apparatus of a size to accommodate it. We believe that the most satisfactory method would be to cut a representative sample from your stock and have the expansion coefficient determined by the Bureau of Standards.

3. It is entirely practicable to roll Invar in sheet form into tubing.

In the absence of data as to the temperature range within which the Invar is required to operate in your specific case, and to the extent of permissible expansion, we are not in a position to comment definitely. But if atmospheric changes only are to be encountered, we suggest that the coefficient of expansion of Invar may be so low (less than one millionth) as to be disregarded.

A Legal Point for Contract Shops

C. I.—An inventor took his drawings to a machine shop to have a machine built that was to be used for the manufacture of tub cover fasteners. The inventor did not apply for a patent either on the machine or the fasteners, nor was anything said about the machine shop not building similar machines for others. Some time after this, a third party went to the same machine shop to have a similar machine constructed, though from different drawings. When the inventor was informed of this, he objected on the ground of the general understanding that a contract shop making a special machine for one person should not make similar machines for others. Can the inventor take legal steps to prevent the machine shop from making the machine for the third party?

Answered by Leslie Childs, Attorney at Law Indianapolis, Ind.

The law does not favor custom or usage that tends to restrain a workman or mechanic from doing productive work, and it is very doubtful if it would base an implied contract on the part of the machine shop not to build a similar machine for a third party, simply because it was employed to build the first machine for the inventor. There being no confidential relations between the inventor and the machine shop, it is probable that the Court would hold the alleged custom and usage to be unreasonable, and decline to give relief to the inventor. (158 N. E. 346)

Power Required for Cutting Multiple Threads with Dies

J. S. D.—How much more power, if any, is required for cutting a double thread than a single thread, assuming that the diameter and pitch are the same, and that a self-opening die-head is used? This information is needed in determining whether a driving belt capable of delivering more power will be required for cutting double threads.

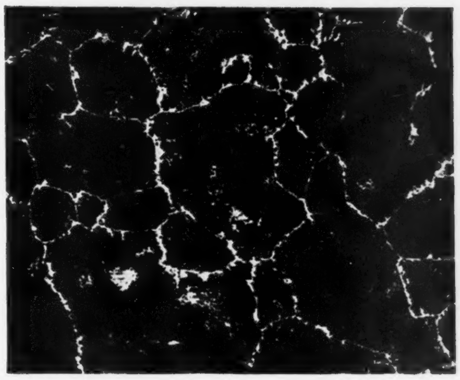
A.—According to very extensive tests conducted by the Eastern Machine Screw Corporation, New Haven, Conn., it requires a little more than twice as much power to cut a double thread as it does to cut a single thread of the same diameter, using self-opening dies. For cutting quadruple threads, the power required was approximately 450 per cent that consumed in cutting single threads. It was also found that dull chasers that had been run until the threads would not pass inspection, consumed almost twice as much power as sharp ones. The complete results of these tests were given in an article on page 210 of November, 1932, MACHINERY.

Composition Alone Does Not Determine the Quality of Steel

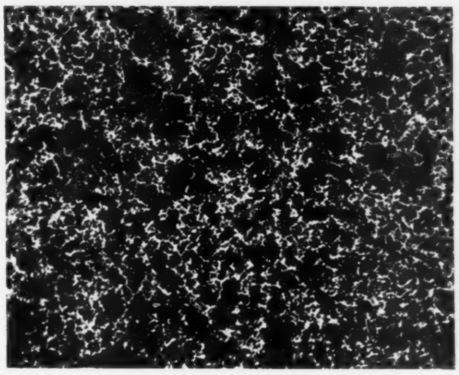
STEEL users, when confronted with unsatisfactory performance of a steel of given analysis in a particular application, are too ready to lay the blame solely on the composition. They forget, or do not know, that the physical properties of steel, particularly after heat-treatment, depend to a great extent upon the care observed in its manufacture. Chemical specifications without end have been created in attempts to obtain steels for specific uses, when steels of standard analyses, produced under carefully controlled conditions, would serve the purpose just as well or better, and generally at considerably less cost.

The reason for this condition may be laid at least partially at the door of the steel manufacturers. Until recently, for example, it was not unusual for even a carbon tool steel to exhibit widely varying properties after heat-treatment, and it was very difficult to assemble a large stock of straight carbon steel that would exhibit uniform properties, behave uniformly in processing, and respond uniformly to heat-treatment. Even bars of the same heat showed variations.

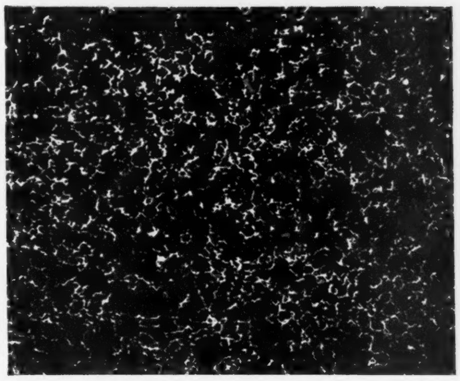
Some steel companies, in recent years, have made extensive studies to determine the underlying metallurgical causes for the different inherent characteristics of steels that are not explained by the ordinary chemical and physical tests. They are now endeavoring to apply systematically the knowledge obtained in this research in every detail of steel-making, with the object of producing steel that is uniform not only throughout each heat, but from heat to heat as well.



TYPE A



TYPE B



TYPE C

Fig. 1. These Three Photomicrographs are of Basic Open-hearth Carbon Steels of Practically the Same Analysis. They Show that Coarse or Fine Grain Structure may be Obtained in the Same Steel (Standard Carburizing Test—100X)

Under such systematic control of the quality factors, the user of a steel selected for a certain purpose can be assured that every successive heat will respond in an equally satisfactory manner to his manufacturing processes.

One of the fundamental factors affecting the characteristics of steel, particularly steels that must be carburized or heat-treated, is the austenitic grain size. This property has been controlled to a greater or lesser extent in the manufacture of tool steel and special alloy steels, but its positive control in the making of basic open-hearth carbon steel has been considered by some to be impossible. However, by systematic supervision of the processes for making basic open-hearth carbon steel, grain size, as defined by the standard test, can now also be controlled to consistently produce steel with either a fine or a coarse grain, as desired.

This has been definitely proved in extensive tests conducted by Carnegie Steel Co., Pittsburgh, Pa. In Fig. 1 are shown three photomicrographs of a given steel. The chemical analyses of Types A and B vary ever so slightly, though the grain size is vastly different, while the grain size of Types B and C is approximately the same, though the chemical analyses show a greater variation than those of Types A and B.

The analyses of these steels are as follows: Type A, carbon, 0.44 per cent; manganese, 0.67 per cent; phosphorus, 0.020 per cent; sulphur, 0.037 per cent; and silicon, 0.23 per cent. Type B, carbon, 0.43 per cent; manganese, 0.67 per cent; phosphorus, 0.020 per cent; sulphur,

0.030 per cent; and silicon, 0.20 per cent. Type C, carbon, 0.39 per cent; manganese, 0.85 per cent; phosphorus, 0.020 per cent; sulphur, 0.040 per cent; and silicon, 0.17 per cent.

Tests conducted with various steel analyses showed exactly the same thing—that either a fine or a coarse grain structure is obtainable, depending entirely upon the manufacturing processes.

The accompanying charts show macrostructures of steels of the same analyses as those in Fig. 1 after the steels have been heated to the temperatures indicated and quenched in water at a temperature of 70 degrees F. Before the hardening, the bars were normalized at 1600 degrees F. The temperatures at which the bars were hardened included the forging and heat-treating ranges. Invariably, Types B and C show a harder outer case and tougher core than Type A. The illustrations are three-fourths actual size and are unretouched.

In many practical tests performed in the plants of thirty manufacturers of automobiles and forgings of various sorts, Types B and C steels have not only given vastly greater satisfaction than Type A, but have also been more easily sheared, forged, heat-treated, and machined. These tests have emphasized the importance of systematic control in steel-making. Excellent, mediocre, or poor physical properties can be obtained with the same steel analysis. The variations in "hardenability" and impact values that may be obtained with steels made to identical analyses and treated in the same way make this control vitally important in the manufacture of steels that are to be heat-treated.

* * *

National Metal Congress to be Held in New York City

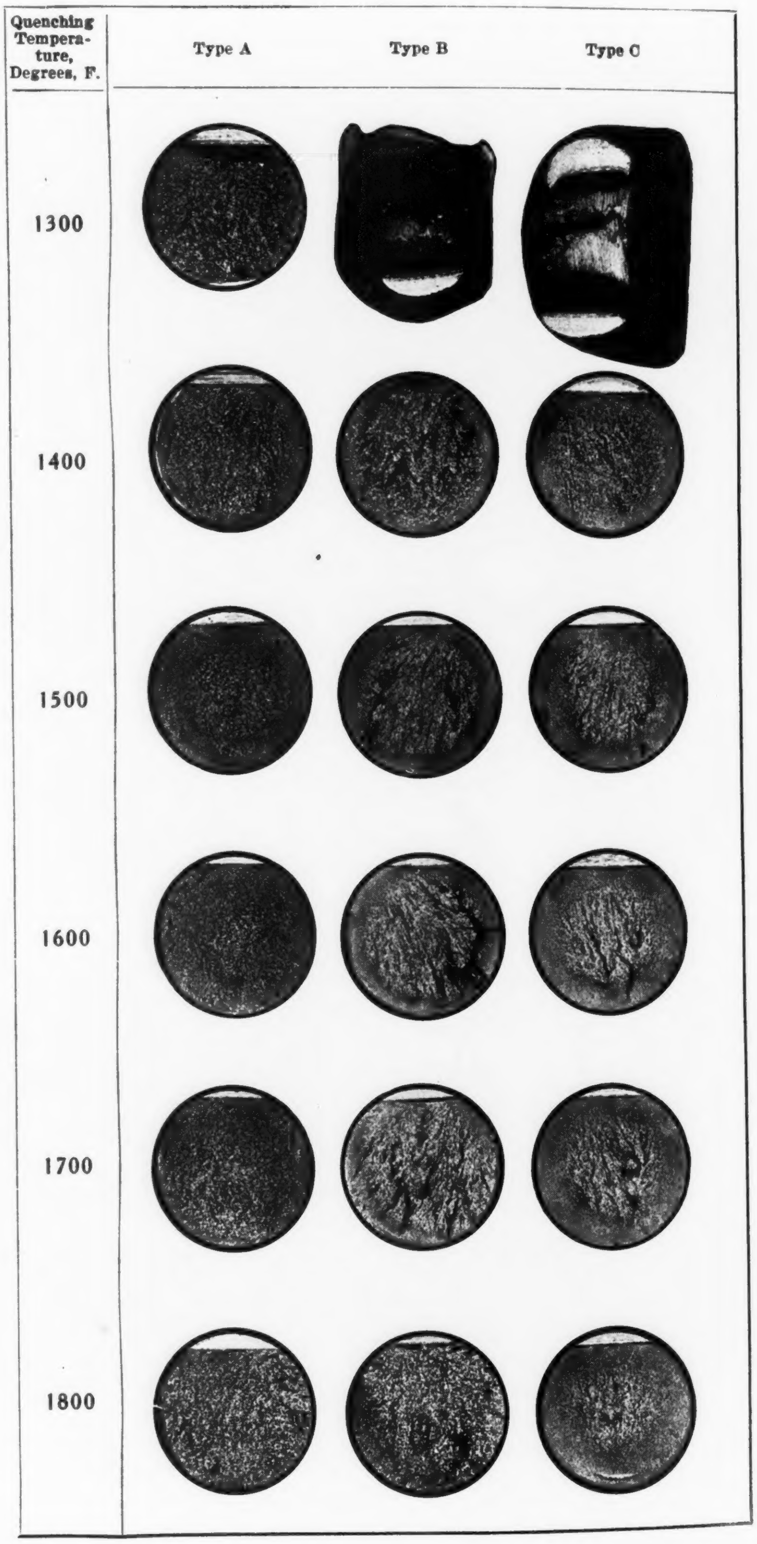
The American Society for Metals (formerly the American Society for Steel Treating) announces that for the first time since it was started, the National Metal Congress and Exposition will be held in New York City. The week of October 1 to 5 has been selected as the date, and Commerce Hall in the Port of Authority Building, at 14th St. and Eighth Ave., has been chosen for the site of the exposition. All the exhibits will be located on one floor, with 160,000 square feet of floor space available. There will be no restrictions as to floor loading or operation of exhibits. Floor plans will be available about March 15.

Two Safety Rules that Proved Effective

By JAMES J. BAULE

Two major accidents in an eastern manufacturing plant led to the adoption of unique safety measures that have proved very effective. The investiga-

Grain and Hardening Characteristics Obtained in Three Steels of Similar Analyses by Quenching in Water from Various Temperatures



tion of these accidents disclosed the fact that in each case the machines and equipment concerned were in good repair and properly guarded, and that prior to the accidents no known hazards existed.

Shop accidents are essentially of two kinds, namely, those over which the operator has no direct control and those caused by his absent-mindedness or carelessness. Realizing this, the superintendent made a special effort to obtain all the information available concerning the accidents, in order to determine where the fault lay. It was found that two equally skilled mechanics were operating a machine, neither one of them being in charge over the other. One of these men started the machine while the other was standing on a ladder in the way of one of its moving parts. A badly crushed leg resulted.

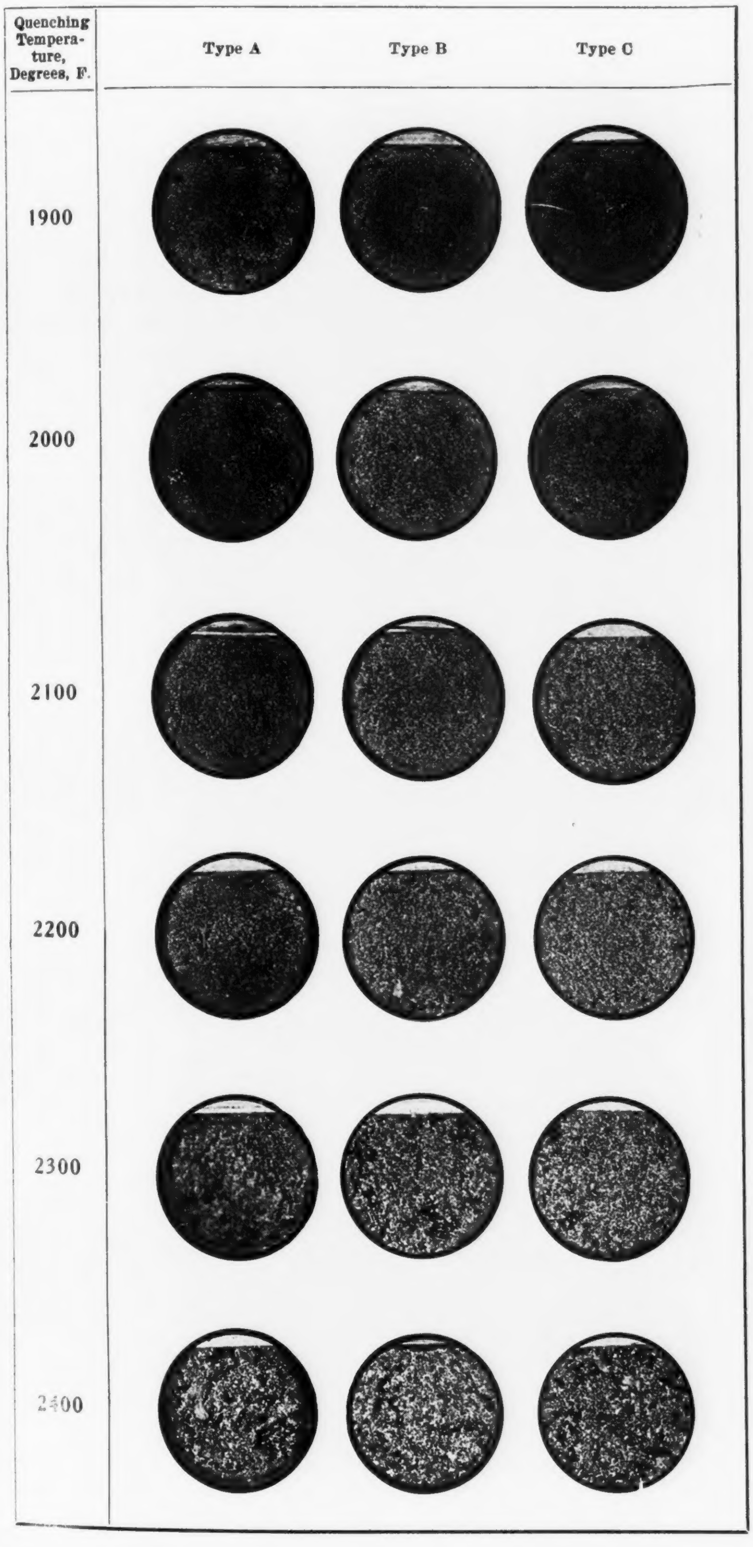
The other accident, which resulted in partial blindness and bad burns about the face of a repair man working on a high tension line, was caused by an operator unthinkingly throwing in the starting switch while the line was undergoing repairs. To avoid such accidents, the management made a rule that no two operators, even though they were men of equal experience and skill, should be allowed to operate a machine unless one of them was in charge of the other. Also, that a machine should not be started by anyone except the man in charge or someone acting directly under his orders. Anyone knowing how to stop the machine, however, could do so in an emergency.

Whenever equipment, such as machines, steam lines and valves, electrically operated equipment, etc., are out of order or would be hazardous to operate, for any reason, a bright red warning disk is conspicuously attached to the handles or controls of such equipment. This disk is about 8 inches in diameter and is made of stiff cardboard. Printed on both sides of the disk is the following warning: "Do not operate—do not remove this sign." In small type below this warning is a note to the effect that only two persons have the right to remove the sign, one being the person who placed it there and whose name and departmental number appear in a space provided for them, and the general foreman. The notation also contains the statement that all persons failing to comply with the regulations will be discharged.

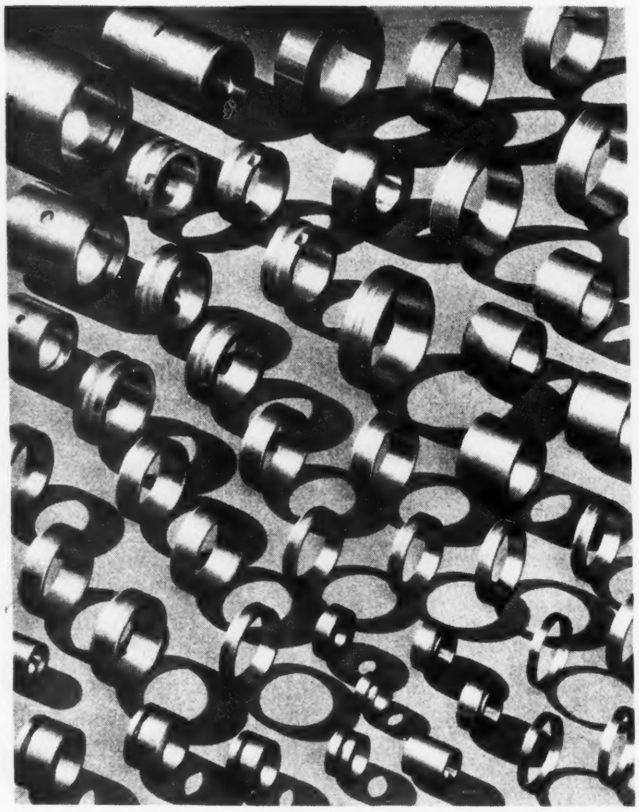
When these safety measures were introduced, each foreman had all the men working under him read the regulations and attach their signature to a statement that they had read and understood them.

The red disks are respected generally, but at the beginning, the management found it necessary to discharge two pieceworkers because of non-compliance with the safety rules. Thus, this firm, by forcing the careless and irresponsible to observe safety rules, has secured greater safety for the workers and lowered the cost of its accident insurance.

Grain and Hardening Characteristics Obtained in Three Steels of Similar Analyses by Quenching in Water from Various Temperatures



Centerless Grinding Now Applied to Internal Work



TWO internal grinding machines based on centerless principles were outstanding exhibits at the show of grinding and precision boring equipment held by the Heald Machine Co., Worcester, Mass., from January 29 to February 3. One of these machines ground a straight hole, 1.500 inches in diameter by 1 1/8 inches long, within a diameter tolerance of 0.0003 inch, and straightness. roundness, and concentricity tolerances of 0.0001 inch. In rough-grinding, 0.009 inch of stock was removed, and in finish-grinding 0.001 inch. The production was 110 pieces an hour.

The taper bore in a roller-bearing race was ground by the second centerless machine. In this operation, the bore was 2.625 inches in diameter at the larger end and 5/8 inch long. The same tolerances were specified on this part as on the piece with the straight hole, and the production was 100 pieces an hour. Taper bores with included angles up to 30 degrees can be ground in these centerless machines.

Some Advantages of Internal Centerless Grinding

Internal centerless grinding utilizes the outside diameter of the work as a path for grinding the bore. Thus the finished bore is concentric with the outside circumference and a uniform wall thickness is obtained. Another important feature of internal centerless grinding is that it makes possible completely automatic loading and unloading of the work, the operator merely having to keep a magazine chute filled with unfinished parts.

When two or more grinding operations must be performed on the same part, as for instance, roughing and finishing, the work can be rechucked in the same location as often as required. In addition to straight and tapered bores, interrupted and blind holes can be ground by the centerless method. The large variety of work that can be performed will be apparent from the heading illustration. Parts as large as 3 inches outside diameter and 3 inches long can be accommodated on the standard machine.

These Heald internal centerless grinders were developed in cooperation with Cincinnati Grinders, Inc., and the Hyatt Roller Bearing Co., Division of the General Motors Corporation. In addition to being fully automatic, the machines are hydraulically controlled throughout and can be furnished with either Size-Matic or Gage-Matic principles of automatic sizing to suit the work. The machines have proved their practicability under production conditions in various industrial plants.

Fig. 2 shows a close-up view of a straight-hole part in the grinding position. It rests on a supporting roll *A* and is held in contact with regulating roll *B* by pressure roll *C*. Roll *B* drives the work and at the same time prevents it from acquiring too fast a speed through its contact with the rapidly revolving grinding wheel. When parts less than 1 1/4 inches outside diameter are ground, a solid blade is used in place of the supporting roll. Pressure roll *C* is mounted on a bracket that swings back out of the way during loading and unloading.

When the grinding wheel, which may be seen at *D*, enters the part, it bears against the inner surface of the work directly in line with its point of contact with the regulating roll. Contrary to usual internal grinding practice, the wheel and work rotate in the same direction. The complete work unit is mounted on a table that travels back and forth longitudinally on the bed, carrying the work to and from the grinding wheel.

Fig. 2 shows the work after it has been ground and withdrawn from the wheel. The first step in

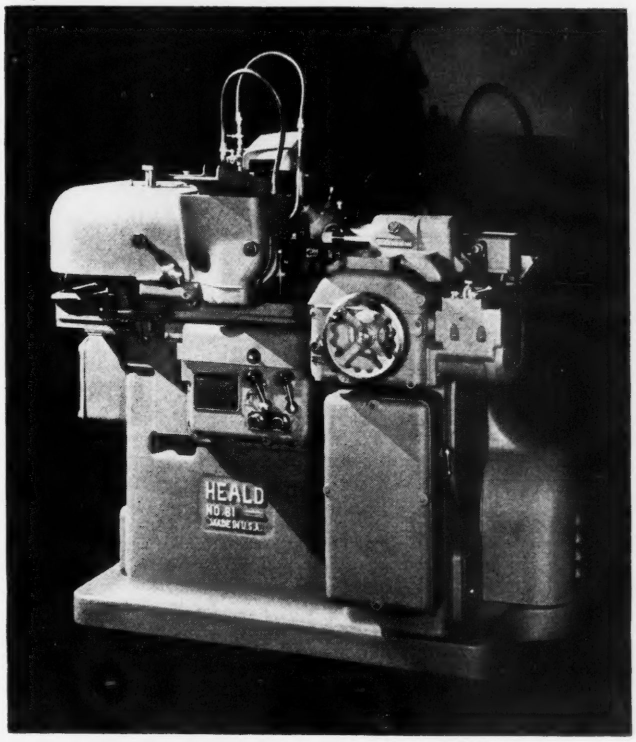


Fig. 1. An Internal Grinding Machine of Centerless Design that will Finish Straight or Tapered Open, Interrupted, and Blind Holes

the loading cycle is for pressure roll C to swing out of the way, as illustrated in Fig. 3. At the same time, the loading arm E rises, pushing the finished work from below until it passes over the top of the regulating wheel, from which point it rolls down an unloading chute. In the meantime, the work-stop F has been raised, so that as the finished piece passes over the regulating roll, a new piece of work is permitted to drop from the loading chute against the back of the loading arm. Then, as this arm descends to its original position, it permits the new piece to drop gradually until it rests on roll A.

When the loading arm again reaches the position shown in Fig. 2, roll C advances to exert pressure on the part ready for grinding. In the grinding operation, rolls A and C revolve as idlers. The loading cycle is controlled by a hydraulically actuated mechanism which is interlocked with the table movements so as to prevent damage to the machine in case a work piece should become jammed. The unloading chute may be seen in Fig. 4.

The work may be both located and squared up from the outside diameter or located from the outside diameter and squared up from the back face. When work with a straight hole is located and squared up from the outside diameter, lands are ground on the three rolls a little less wide than the piece being ground. The work is prevented from moving endwise by guides fastened to the loading chute.

In grinding taper holes, the work must be accurately held endwise, as variations in the endwise location would affect the diameters of the hole. For this reason, taper work requires a backing plate when located from the outside diameter. Narrow lands, sufficient to drive the work, are ground on the rolls. but as they are narrow in relation to the width of the piece, they do not have any

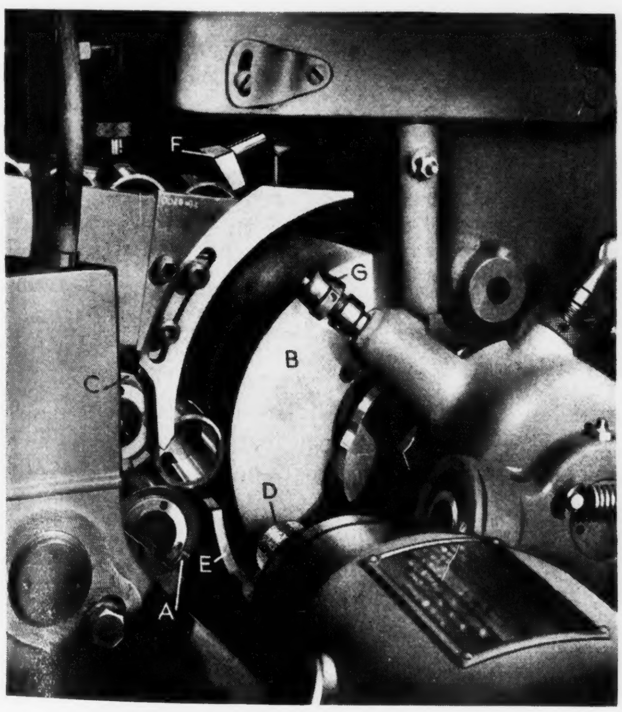


Fig. 2. The Work is Held between Three Rolls and is Driven from its Circumference

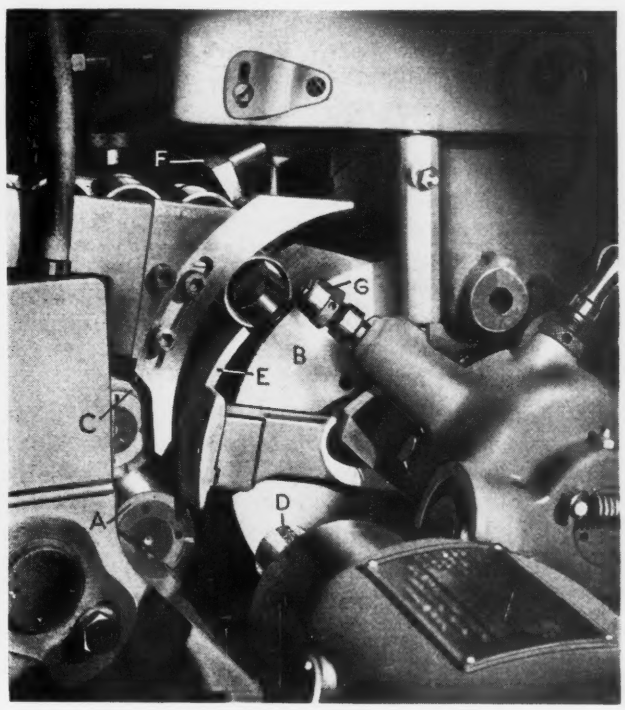


Fig. 3. The Finished Part is Ejected over the Regulating Roll by a Rising Arm

great squaring-up tendency. To meet this condition, a three-point revolving backing plate is used. With this arrangement, some means must be found for holding the work against this plate. This is accomplished by skewing the rolls slightly so that they tend to feed the part backward and thus hold it firmly in contact with the backing plate during grinding.

The Automatic Grinding Cycle

After a new piece of work has been automatically loaded as described, the work-table moves toward the grinding wheel. When the wheel is about to enter the hole, it first recedes and then, by means of a pick-up feed, is brought into contact with the work to take a plunge cut. This eliminates any chance of breaking the corner of the wheel as it enters the work, and is also advantageous when an irregular amount of stock has been left for grinding. The wheel-head movement now changes to a roughing feed and the table reciprocates at a roughing speed for rapidly removing a large amount of stock.

At a predetermined point, the wheel-head movement changes to a finishing feed, thus relieving the strain and spring of the spindle before truing the wheel. When the hole has been brought to nearly the finished size, the wheel recedes and the work is withdrawn from the wheel. The table now changes to a truing speed, all feed stops, and a diamond in holder *G*, Fig. 2, drops into position for truing the wheel. Upon the completion of the truing operation, the wheel re-enters the hole in the work and grinding is continued at a finishing feed, the table reciprocating, of course, at a finishing speed. When an extremely fine finish is desired, there can be included in the grinding cycle a spark-out feed, which amounts to almost nothing.

As the required size of the work is reached, the wheel backs off to eliminate any chance of producing a bell-mouth or scratches when the work withdraws. All units then assume their rest positions and the cycle is completed. In the truing operation, the diamond is hydraulically lowered into the path of the wheel and positively raised by a cam on the cross-slide. It can also be operated manually for truing a new wheel.

The Gage-Matic and Size-Matic Methods of Sizing the Work

The Gage-Matic method of sizing the work is recommended by the manufacturer in grinding straight open holes when the bore is at least 1 inch wide and one piece is ground at a time. This method consists of using a plug to automatically test the diameter of the bore each time that the grinding wheel leaves the hole. When the plug can enter the bore, the desired dimension has been attained and the operation stops. This sizing plug can be seen in Fig. 2 at the back end of the work.

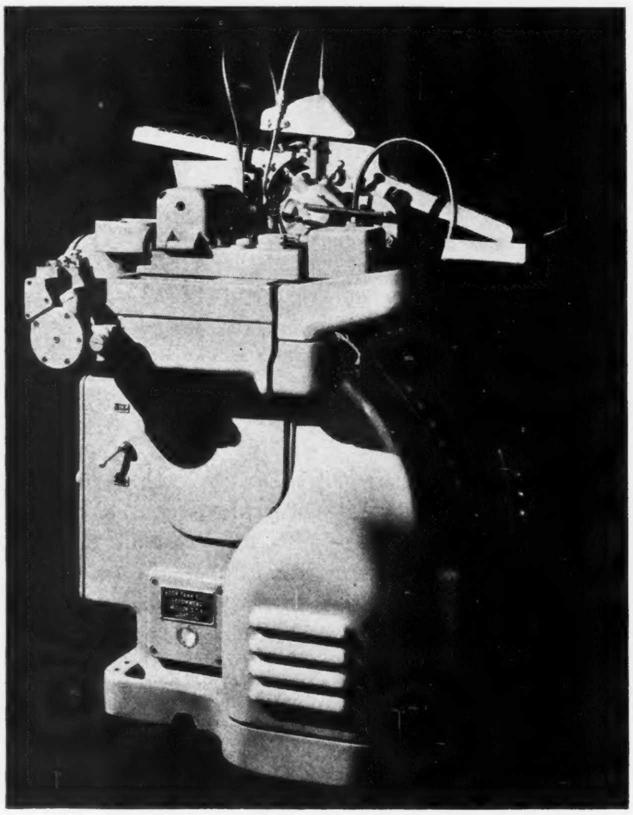


Fig. 4. The Centerless Internal Grinding Machine from One End, Showing the Arrangement of the Loading and Unloading Chutes and the Design of the Guards that Enclose the Main Motor, Pumps, and Driving Belts

In grinding taper or blind holes, or two pieces at a time, the Size-Matic method of sizing is used. With this method, sizing is controlled by the cross-slide and the wheel truing unit. The diamond is set to true the wheel at a definite relation to the finished size of the hole. After this has been done, a definite advance of the cross-slide will bring the work to the required dimensions.

In setting up a Gage-Matic internal centerless machine, a finish-ground piece of work is slipped over the gages and the three rolls are adjusted to contact with the outside diameter of the part. On a Size-Matic machine, a special plug is used, which fits into a ground hole in the backing plate or fits on the backing-plate carrier when no plate is used.

Practically all controls and movements of these machines are hydraulically operated, including the reciprocation of the table and the feed of the cross-slide. The table is reciprocated by a cylinder and piston unit. The dogs that control the table movements are covered by a swinging guard. Each dog has a plate that gives full instructions for adjustment. A Red Head wheel-head is used. When the

wheel reaches its smallest allowable diameter, a limit switch stops the entire machine.

The driving motor for the pumps and the wheel-head is enclosed at the end of the machine. An individual motor drives the regulating wheel spindle, there being provision for swiveling this unit in order to grind taper work. The regulating wheel is adjustable transversely to suit various diameters of work. All units, mechanisms, and belts are covered by guards. The oil reservoir in the lower part of the base is completely enclosed to eliminate dirt and other foreign substances. Forced-feed lubrication is supplied to the table ways. The net weight of these machines is approximately 5000 pounds.

* * *

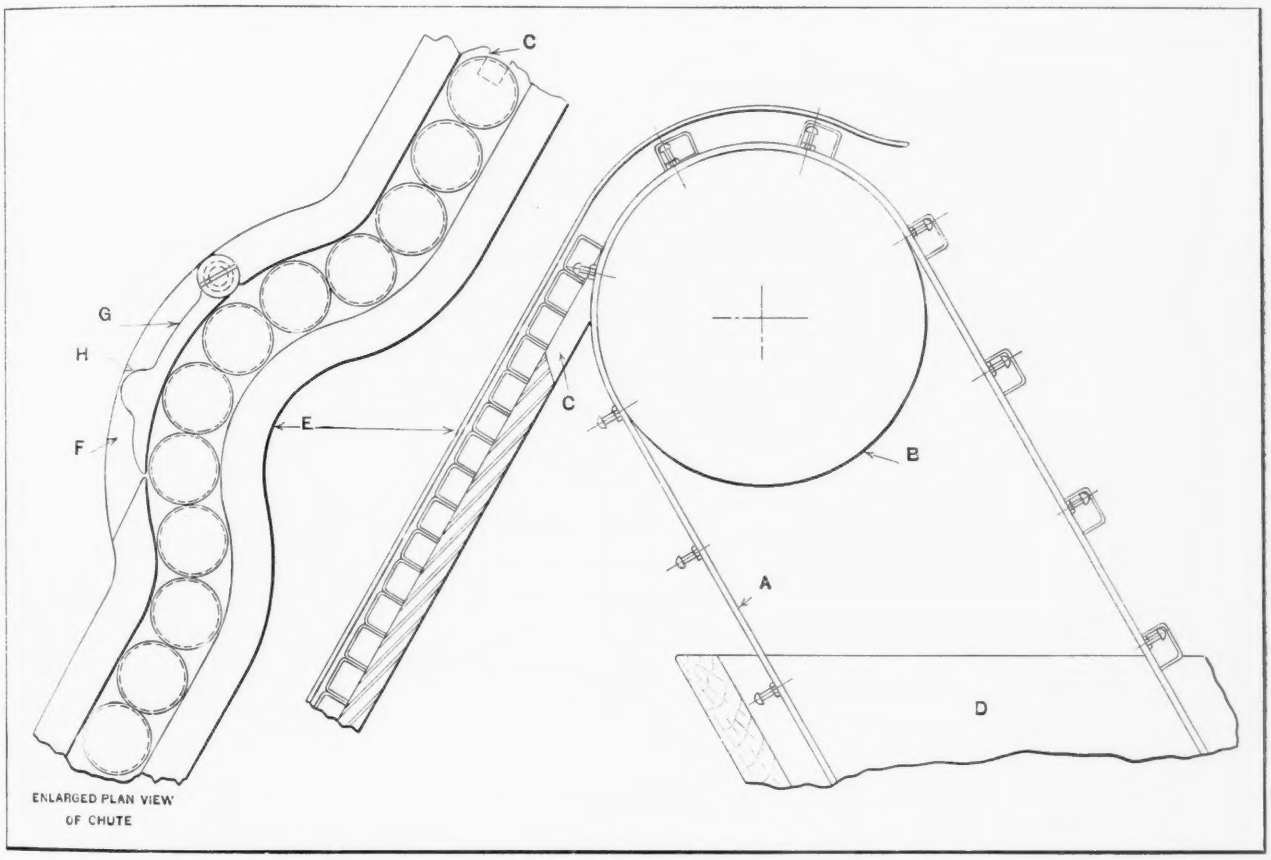
Remarkable Record in Safety Work

A remarkable record in safety work has been established by the Western Clock Co. of La Salle, Ill. The company reports that there has not been a single lost-time accident of any kind during six and a half million man-hours. In recognition of this remarkable record, which was brought about through the cooperation of the employes, the company gave the workers a half-holiday at full pay. This is the second year that this record of no accidents has been maintained—a most unusual achievement in a large industrial plant.

Preventing Brass Shells from Jamming in Hopper Chute

By J. E. FENNO

A device that proved successful in preventing brass shells from jamming in a delivery chute leading from a hopper to a dial press is shown in the accompanying illustration. The belt *A*, driven by the pulley *B*, is studded with a series of round-head screws which collect the shells as the belt passes through the hopper container *D*. These shells, which are carried up and into the chute, are finally stripped from the belt as the screws pass through the slot *C*.



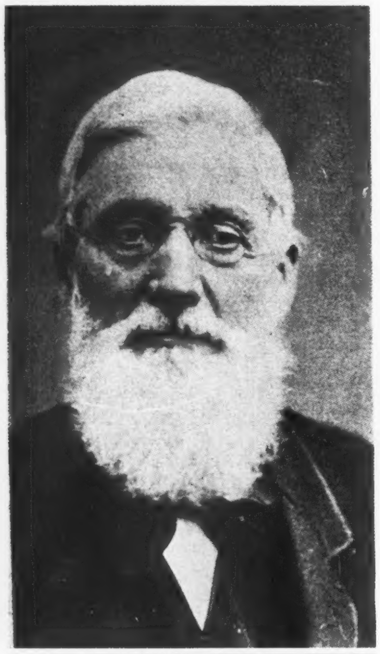
Device for Hopper Chute which Prevents Shells from Jamming

It is evident, if provision is not made for removing the shells from the chute at least as fast as they are fed into it, that jamming will occur. This is prevented by offsetting the chute, as shown at *E*, removing a side section at *F* and adding the swinging finger *G*. This finger has sufficient added weight at *H* to permit a light pressure to be exerted on the shells and thus retain them in the chute.

When the chute becomes filled, further feeding of the shells will transmit sufficient pressure against the finger to swing it outward, allowing the shells to drop out the side at *E* and into a runway, sloped to return them to the hopper. When the pressure on the line of shells is relieved, the finger returns to the position shown.

Gould & Eberhardt Celebrate One-Hundredth Anniversary

ONE hundred years is a long time, particularly so in the machine tool business, since there are only three American concerns in this field that can point with pride to so many years of continuous existence. The close of 1933 marked the one-hundredth anniversary of Gould & Eberhardt, Newark (Irvington), N. J., well-known builders of automatic gear-cutting machines and shapers. This business was established a hundred years ago, when Ezra Gould, a native of Paterson, N. J., opened up a machine shop at Newark in one room, 12 by 16 feet in size.



(Left) Ezra Gould Who, a Hundred Years Ago, Started a Modest Machine Shop that Developed into the Business of Gould & Eberhardt. (Right) Ulrich Eberhardt, First Apprentice, Then Partner, and Finally Sole Owner of the Business After Mr. Gould's Retirement

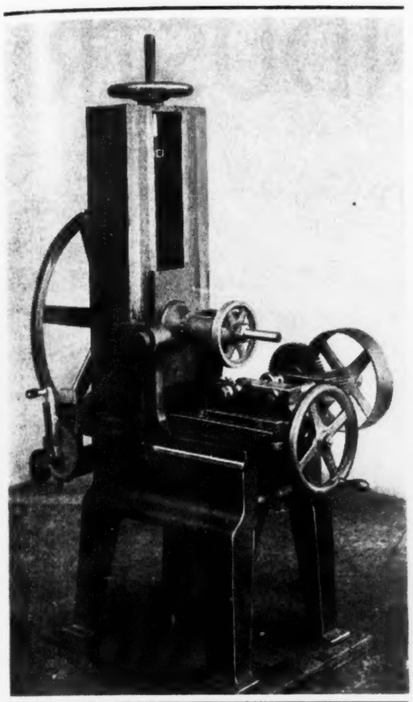
The products of this small shop must have quickly acquired a reputation for satisfactory performance, because in a few years it was found necessary to move into a building where much larger quarters were available. In the meantime, the enterprise had been organized as the Gould Machine Co. The line of machine tools made at that time included lathes, planers, and upright drilling machines. In addition, a line of high-grade fire engines was built.

In 1851, Gould constructed one of the earliest gear-cutting machines. This hand-operated machine was exhibited at the Crystal Palace in New York City and won a silver medal. What is believed to be the first shaper built in America was made in 1854. Before the Civil War, the shop had added a milling machine, a foot-operated punch press, a bolt cutter, and various other types of equipment to its line of products.

Eight years after Ezra Gould had started his machine shop, there was born in a small village in Switzerland a boy who was destined to play a prominent part in the development of this industrial enterprise. This boy, Ulrich Eberhardt, was descended of noble German ancestry, although his parents were not possessed of wealth. In the early fifties, his father emigrated to the United States, with his family, and settled in the town of Newark.

Ulrich Eberhardt started to earn his living in the new country by stripping tobacco. He spent his nights in the Newark evening schools, learning the English language. Determined to devote his life to mechanical pursuits, he apprenticed himself to Ezra Gould and applied himself with such industry and enthusiasm that he was made foreman of the shop while still an apprentice and receiving only an apprentice's wage of $3.50 a week. In 1874, the concern employed 150 men, and the weekly payroll was $1500. The yearly business amounted to $150,000. Machines were exported to England, France, Germany, Cuba, and Mexico.

In 1877, Mr. Gould, recognizing Mr. Eberhardt's qualities of leadership and organizing ability, made him a partner, the business then being known as E. Gould & Eberhardt. In 1890, Mr. Gould retired from the concern at the age of eighty-two, and Mr.



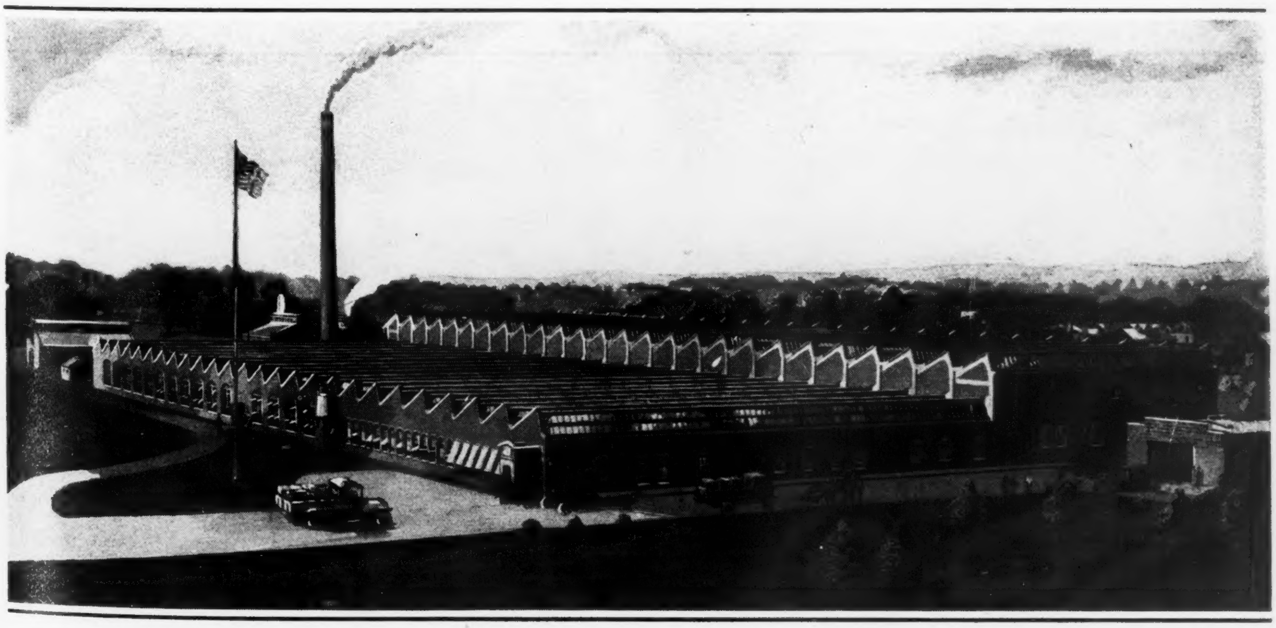
(Left) The First Gear-Cutting Machine Built by Ezra Gould. (Right) The First Metal Shaper — Both Machines are Still in Existence and are on Exhibit at the N. Y. Museum of Science and Industry

Eberhardt assumed complete control. The business was later incorporated under its present name.

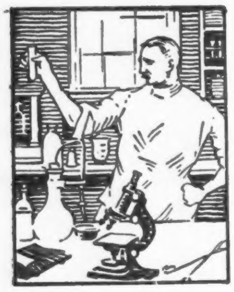
At the time that Mr. Eberhardt became sole owner, the firm had already won a reputation for building high-class machine tools. Under his direction, special attention was paid to the development of automatic gear-cutting machines, shapers, and upright drilling machines. When the first demand for American machine tools came from Europe, such a large export business was added to the domestic business that greatly increased manufacturing facilities were required. The building that the concern then occupied was therefore reconstructed completely into an enlarged steel structure without interrupting the operation of the machine shop.

Both Mr. Gould and Mr. Eberhardt died in 1901. Three of Mr. Eberhardt's sons have conducted the business since that time. They are Fred L. Eberhardt, president and general manager; H. Ezra Eberhardt, vice-president and secretary; and Ulrich Eberhardt, treasurer. In 1917, the company moved into its present modern plant at Irvington.

The Present Home of Gould & Eberhardt at the End of One Hundred Years of Machine Tool Building



MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Selecting a Stainless Steel for Fabrication

The characteristics of stainless steels are so varied that the prospective user sometimes becomes confused in choosing a stainless steel for fabrication. Stainless steels may be divided into three groups—austenitic, martensitic, and ferritic. The members of each group have similar characteristics.

As defined by the Allegheny Steel Co., Brackenridge, Pa., the austenitic stainless steels are composed chiefly of chromium, nickel, iron, and manganese. These steels are non-magnetic and cannot be hardened by heat-treatment. In the annealed condition, they are relatively stiff, but extremely ductile. All steels of this group harden excessively when worked either hot or cold.

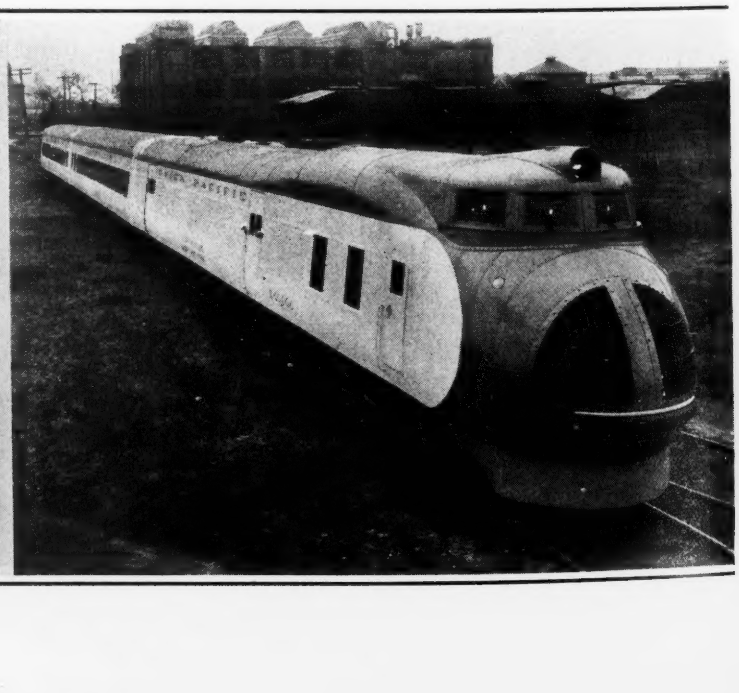
The martensitic stainless steels are composed mainly of chromium, iron, and carbon. These steels are magnetic and can be hardened and tempered by heat-treatment in the same manner as ordinary carbon steels, except that they harden greatly when cooled in air.

The ferritic stainless steels contain chromium in excess of 18 per cent. These steels cannot be hardened. When properly annealed, they are relatively strong and quite ductile.

Amolastic—a Material for Repairing Shop Floors

A cold mastic compound for repairing the floors of shops and factories has recently been placed on the market by the Floor Treatment Division of the American Oil and Disinfectant Corporation, 129 E. 26th St., New York City. This material, which is known as Amolastic, is mixed with large quantities of cement, sand, and gravel or trap rock. A wearing surface hard enough to withstand heavy loads on steel wheels or a floor soft as rubber for foot traffic can be obtained by merely varying the amount of the aggregate mixed with the compound. Amolastic can be bonded to concrete, asphalt, composition, or brick floors.

Aluminum Reduces the Weight of This Three-car "Tomorrow's Train Today," to that of a Single Pullman Sleeper. A Twelve-cylinder, 600-horsepower Internal Combustion Engine Connected to an Electric Generator will Drive this Union Pacific Streamline Train at Speeds up to 110 Miles an Hour



Brake-Drums and Cylinder Sleeves Made from Cannonite

An electric-furnace low-carbon-chromium alloy known as Cannonite has been developed by the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., for sand-casting automobile brake-drums and centrifugally casting cylinder sleeves and liners. This alloy has a higher tensile strength than ordinary cast iron and possesses exceptional wearing properties.

Factors that Influence the Machineability of Steel

The characteristics of steel that have the most pronounced effect on its machining properties are tensile strength, ductility and structure, according to the Union Drawn Steel Co., Massillon, Ohio. In general, all other things being equal, the lower the tensile strength and ductility, the better the machining properties. As regards structure, the machining properties are better in a steel of coarser grain.

The machineability of steel can be improved by providing some constituent that will break up the continuity of the ferrite, which is the principal element of steel, provided the constituent is not abrasive in character. A typical example is the influence of manganese sulphide in high-sulphur steels. Whether or not the chemical composition of any steel produces a combination of tensile strength, ductility, and structure that is favorable to good machineability, the machining properties can be greatly improved by processes or heat-treatments.

One of the simplest methods of obtaining good machineability is cold-drawing; this process affects the ductility principally. Annealing is, of course, of great value in improving the machining properties. The simplest effect produced by annealing is softening of the steel and lowering of its tensile strength. This was about the only use made of annealing before the fundamentals of machineability were well understood. Developments have made clear the relation of microscopic structure to machining properties, and through a careful study of this relationship, annealing treatments have been found invaluable for improving the machineability of steel.

The study of machineability has brought about important changes in steel-making practice during recent years. Certain elements and types of inclusions have been found to affect machineability adversely and so steel-making procedure has been altered to eliminate or minimize the influence of such impurities.

While Chromium is of Recent Use, It Has Long Been Known

The use of chromium commercially dates back but twenty years, according to the Republic Steel Corporation, Massillon, Ohio, and only within the last five years has it been used extensively. Nevertheless, the element chromium was discovered as long ago as 1789—the year that the Constitution of the United States went into effect. The acid-resisting properties of chromium-iron alloy were known as early as 1821. Hundreds of patents for various chromium stainless alloys have been granted in this country and abroad since 1913.

Light Weight is Also a Feature of This Texas & Pacific Stainless Steel Train Built by the Budd Mfg. Co., Philadelphia, Pa. It was Possible to Use Thin Sheets in its Construction because of the High Strength of Stainless Steel. This Train is Air Conditioned, Rubber Tired and Gasoline Driven

The Shop Executive and His Problems

Superintendents and Managers are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

THE article in January MACHINERY (page 298) "Works Councils in American Industry" is timely. Since the codes went into effect, most employers have had to give some thought to this subject.

Without in any way objecting to labor organizations, the writer believes that a truer representation of workers may be had under the works council plan than under any other. Here the employe is represented by men engaged in the same work as he is—men who have a thorough understanding of his work and the conditions under which it is performed. It is difficult for men who make it their regular work to act as intermediaries to be truly representative. They do not understand the full viewpoint of the workers any more than they do that of the employer.

I believe that the works council plan is satisfactory both to employe and to employer. It is misunderstood in many plants, because it is thought that such a council necessarily would be under the employer's control, and that the representatives would not dare to present their case, fearing to lose their jobs.

Nothing could be further from the facts, as actually on record in plants where works councils are in operation. It would be of interest to learn from those who have had personal experience with works council plans how successful such plans have been. Brief comments on this subject would be of value to both employers and employes.

CHARLES R. WHITEHOUSE

Demonstrating Small Machine Tools at the Customer's Door

In selling any kind of product, even a machine tool, it is, of course, advantageous to be able to show the prospect exactly how it works and to explain its good points by actual demonstration. No matter how capable a salesman may be in explaining the advantages of a machine, there is nothing so convincing to the prospective buyer as that which he can see with his own eyes. With heavy machinery, a demonstration is not possible, except at an exposition or at a plant where the machine is in operation. On the other hand, many small machine tools can be demonstrated right at the customer's door. This applies not only to portable hand tools, but to machine tools that are not too large to be mounted on a truck and that are equipped with a motor drive that can be operated from an ordinary lighting outlet.

With such an arrangement, it is possible to bring the machine directly to the door of the plant or to run it into the yard, where it can be inspected, not only by the man who finally settles on the purchase, but also by the foremen and machinists who are interested in the machine. By having a long extension cord connected with the motor, it is a simple matter to plug into some accessible outlet so that the tool can be shown in operation. It is also possible to demonstrate the machine on the product of the plant itself. During the demonstration the possible savings and other advantages can be explained.

One of the greatest advantages of this kind of selling effort is that it is made directly to those who are mechanically interested and competent to judge. In one instance, the salesman made it a practice, whenever possible, to park his truck outside of the window of the mechanical executive chiefly interested. Thus he aroused his interest before calling on him.

This method of selling has been used with marked success in several cases. The results obtained justify the suggestion that the idea could be applied more widely. It can be used both for general-purpose equipment and for special machines—perhaps even more so for the latter, because they are not so well known.

FRANCIS A. WESTBROOK

An Executive that Builds up Good Will

Visitors wishing to see the busy works manager of a large eastern industrial plant are first ushered into the office of his secretary, which immediately adjoins the "Sanctum Sanctorum." Almost the first thing that strikes the caller's eye after he has presented his business card to the young lady behind the desk is the prominently displayed sign: "Executive: A person employed to talk to visitors so that other employes will get a chance to work."

Here is an executive who undoubtedly builds up a large amount of good will for his company and himself by announcing that he believes that any person calling on a business matter should be courteously received by someone with authority in the organization. Thus the caller is assured that the matter he has to present will be given careful consideration.

H. O. C.

NEW TRADE  LITERATURE

Any of these Publications can be Obtained by Writing to the Manufacturer or to MACHINERY. Send for Your Copy Today.

Hard-Facing

HAYNES STELLITE CO., Kokomo, Ind. Book entitled "Hard-facing with Haynes Stellite Products," consisting of 95 pages, 8 1/2 by 11 inches, containing illustrated descriptions of a great number of hard-facing applications. A detailed description is also given of various hard-facing materials and the correct procedure for their application by both the oxy-acetylene and the electric arc process. Jigs and fixtures that facilitate hard-facing operations are also described; tables are given for estimating hard-facing costs; and a list of ferrous and non-ferrous metals and alloys is included, showing what materials can and cannot be hard-faced. The book is an attractive example of the printer's art as well.

Ball Bearings

NEW DEPARTURE MFG. CO., Bristol, Conn. Ninth edition of the New Departure ball bearing catalogue, giving dimensions, load data and list prices of the complete line of ball bearings made by this concern, which includes single- and double-row ball bearings, flanged precision bearings, Radax bearings, magneto bearings, shielded bearings, snap ring bearings, clutch throw-out bearings, N-D-Seal bearings, and front wheel bearings. Other sections of the book contain information on bearing design and load characteristics; typical mounting designs; factors for the selection of bearings; and fits and weights for all bearings.

Roller Chains and Sprockets

WHITNEY MFG. CO., Hartford, Conn. Catalogue V-115, on roller chains and sprockets, giving dimensions and ultimate breaking strength of the various sizes and types of roller chains. Considerable general information is given of interest to those installing this class of drive, including data on lubrication, installation and maintenance, design and selection of roller chain drives, horsepower ratings, and roller chain lengths. There are six pages of tables of sprocket diameters, giving dimensions for sprockets with teeth from 9 to 130 in pitches from 3/8 inch to 2 inches. Tables of stock sprockets are also included.

Screws and Nails

PARKER-KALON CORPORATION, 200 Varick St., New York City. Fourth edition of the Parker-Kalon Catalogue-Data Book on screws and nails. The book contains thirty-six pages of information relating to fastening problems. Particular attention is directed to four new products that have been added to the line, namely, Hex Head hardened self-tapping cap-screws; Type Z non-corrosive self-tapping sheet-metal screws made of stainless steel; cold-forged wing-nuts; and cold-forged thumb-screws.

Lathes

MONARCH MACHINE TOOL CO., Sidney, Ohio. Bulletin 132-D, describing in detail the features of Monarch lathes. Some typical jobs machined on these lathes are illustrated, and several of the most recent additions to the line are described, including the Monarch-Keller form-turning machine, the full automatic lathe, and the cam-milling attachment for the electrically controlled lathe, which is described in the Shop Equipment News section of this number of MACHINERY.

Separators

SHARPLES SPECIALTY CO., 23rd and Westmoreland Sts., Philadelphia, Pa. Circular descriptive of the new Sharples laboratory super-centrifuge, which makes available an extremely high separating force for the sedimentation of solids from liquids, the clarification of liquids and the separation of emulsions and other mixtures. This equipment is used in industry for such applications as paint and enamel analysis, laboratory control work, research work, and the recovery of materials.

Gas Welding and Cutting Equipment

AIR REDUCTION SALES CO., 60 E. 42nd St., New York City. Catalogue entitled "Machine Gas Cutting," covering the salient facts about this process and the machines employed. The first section of the book contains a large number of illustrations showing the almost unlimited possibilities for the profitable use of the gas cutting process. Following this, descriptions are given of the different cutting machines.

Air Compressors

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin illustrating and describing Worthington single horizontal, single-stage compressors, made in both steam-driven and motor-driven units. Bulletin L-612-B1A, illustrating and describing Worthington feather valve horizontal duplex motor-driven compressors.

Flexible Couplings

SMITH & SERRELL, 62 Washington St., Newark, N. J. Circular descriptive of the Waldron Torque Ring coupling, an all-steel, lubricated gear type coupling employing the new patented principle of quadruple engagement, which permits easy endwise displacement and angular misalignment of the connected shafts. The design details are explained, and a table of sizes, capacities, and prices is included.

Hoists

HARNISCHFEGER CORPORATION, 4400 W. National Ave., Milwaukee, Wis. Bulletin RH-1, covering a wide variety of hoists for all purposes. The catalogue shows the application of these hoists to both general and spe-

cific problems. It discusses the vital points in modern hoist design, and shows diagrams explaining simplified construction and operation. The ratings and operating ranges of Type R hoists are listed.

Electric Control Apparatus

ALLEN-BRADLEY Co., 1331 S. First St., Milwaukee, Wis. Circular describing the features of construction and the advantages of the new Allen-Bradley Bulletin 709, across-the-line, alternating-current starting switch, which is available in three forms with maximum ratings of 3 horsepower, 110 volts; 5 horsepower, 220 volts; and 7 1/2 horsepower, 440 to 550 volts.

Die-Heads

GEOMETRIC TOOL Co., New Haven, Conn. Booklet announcing the new line of Geometric combination circular and tangent chaser die-heads. The outstanding features of these die-heads are described and the various accessories are illustrated. Principal specifications are given for both the rotary and the stationary types.

Collapsible Taps

LANDIS MACHINE Co., Tap Division, Waynesboro, Pa. Bulletin G-83, giving detailed information and complete specifications of the new Landis Style LT collapsible tap for straight tapping. Bulletin G-81, containing specifications and other data covering Landis Style LM receding-chaser collapsible tap for tapered work.

Ball Bearings

FAFNIR BEARING Co., New Britain, Conn. Condensed catalogue No. 17, containing information on the industrial uses of radial ball bearings and on the Fafnir line of ball bearings and power transmission units. Complete information is given including tables of interchangeability, dimensions, prices, etc.

Machine-Molded Gears

POOLE FOUNDRY & MACHINE Co., 3701 Clipper Mill Road, Woodberry, Baltimore, Md. 302-page catalogue of machine-molded gears, listing approximately 10,000 different sizes, kinds, and types. The gears included range in size from 3 inches to 15 feet in diameter, and in weight from 5 to 70,000 pounds.

Cam-Grinding Machines

LANDIS TOOL Co., Waynesboro, Pa. Catalogue C-33, describing Landis 5-inch, semi-automatic, hydraulic cam grinders. The catalogue is profusely illustrated with large-scale halftones clearly showing the various details of these machines. Complete specifications for the various sizes are included.

Viscosity Regulator

MERRITT ENGINEERING & SALES Co., INC., Lockport, N. Y. Bulletin 3307, illustrating and describing the Meyers-Mesco viscosity regulator, indicator, or recorder, designed to regulate automatically and continuously the viscosity of heavy fuel oils, lacquers, lubricating oils, printing inks, etc.

Electric Motors

EMERSON ELECTRIC MFG. Co., 2018 Washington Ave., St. Louis, Mo. Folder illustrating and describing the company's improved split-phase motors especially intended for oil burners, office appliances, small pumps, compressors, fans, blowers, air conditioners, and small machine tools.

Bronze Castings

SUPERHEATER Co., Bronze Foundry Division, East Chicago, Ind. Bulletin B-1, giving the composition and properties of the three types of Elesco bronzes—namely, standard bronzes, aluminum bronzes, and super-tensile manganese bronzes—and describing typical uses of the different grades.

Electric Motors

J. D. CHRISTIAN, ENGINEERS, 514 Brannan St., San Francisco, Calif. Circular containing specifications covering the Rite-Lo-Speed motor, a power unit combining a helical-gear transmission and a motor of any make or characteristics to deliver power at the required speed.

Roll-Feeding Straighteners

WATERBURY FARREL FOUNDRY & MACHINE Co., Waterbury, Conn. Circular illustrating the new Waterbury Farrel roll-feeding straightener, designed for use in connection with punch presses, which is made in portable and stationary types, and in three sizes.

Drills for Glass, Stone, etc.

CERAMIC DRILL Co., INC., 139 E. Lexington St., Independence, Mo. Leaflets containing data, including price list, on the Ceramic drill, designed to fill the need for a portable tool for the high-speed drilling of glass, stone, slate, marble, tile, porcelain, etc.

Flexible Couplings

WHITNEY MFG. Co., Hartford, Conn. Bulletin V-110, containing data on Whitney roller chain flexible couplings, including formula for finding coupling horsepower; table of dimensions; horsepower ratings, and weights; and list prices.

Speed Reducers

D. O. JAMES MFG. Co., 1120 W. Monroe St., Chicago, Ill. Circular illustrating typical examples of the D. O. James line of speed reducers, ranging from the individual type to the motorized reducer, with inbuilt safety factor.

Aluminum Products

ALUMINUM COMPANY OF AMERICA, Pittsburgh, Pa., is issuing a monthly publication known as the *Aluminum News-Letter*, which is intended to acquaint the readers with the most recent developments in the aluminum industry.

Cold-Drawn Steels

UNION DRAWN STEEL Co., Massillon, Ohio. Circular entitled "Making Steel Machineable," discussing the effect of the cold-drawing and the annealing processes on the machining properties of steel.

Electric Furnaces

W. S. ROCKWELL Co., 50 Church St., New York City. Leaflet 345, outlining the advantages of the Rockwell belt-conveyor type of electric furnace, and giving standard sizes and capacities.

Hydraulic Pumps

JOHN ROBERTSON Co., INC., 133 Water St., Brooklyn, N. Y. Bulletin containing data on the Robertson vertical triplex high-pressure hydraulic pumps.

Flexible Couplings

D. O. JAMES MFG. Co., 1120 W. Monroe St., Chicago, Ill. Folder entitled "Flexible Couplings," illustrating and describing the company's products.

Self-Protected Motors

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Circular giving complete information on Westinghouse Thermoguard self-protecting motors and their applications.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

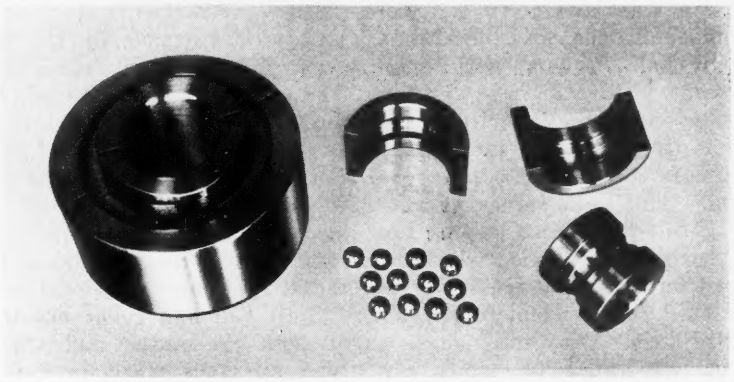


Fig. 1. Radial Ball Bearings of a Split Design that Can Be Used in Many Cases where Solid-race Bearings Cannot be Applied

Split Radial and Thrust Ball Bearings

Ball and roller bearings that are split through the center for convenient installation in places where solid-race anti-friction bearings cannot be applied are now manufactured on a production basis by the Split Ballbearing Corporation, Lebanon, N. H. These bearings are also intended for certain applications where solid-race bearings can be applied, but where the split type would be more economical or would permit a simpler design to be employed. Split bearings have been found to be particularly advantageous in simplifying service work on machines and mechanical units.

In making these ball bearings, the practice is to machine the races complete, except for a finish-grind, and then fracture them by a special process on which the Split Ballbearing Corporation owns patents. Standard lineshaft and pillow-block mountings can be supplied for the large bearing at the left in Fig. 1. A lineshaft mounting contains a split bearing at each end. In the case of a pillow-block, either a straight or self-aligning assembly is available. In the self-aligning type, the outer race of the bearing and its seat in the housing are spherical.

The bearing at the left in Fig. 1 is a 1 3/16 inch radial bearing of the split type, supplied for lineshafts and similar applications. Both races are split in line with the saw grooves. These grooves, of course, do not extend to the surfaces on which the balls revolve. The race halves are tightly assembled on the fractured surfaces, which provides an exact alignment and an interlocking engagement that is proof against displacement. Thus the assembled races are, in effect, solid.

The construction of a split radial bearing will be apparent from the smaller disassembled bearing at the right in Fig. 1. This bearing is used in the connecting-rod of a water pump. The two halves of the outer race are shown apart and the halves of the inner race assembled. During assembly, the two parts of either race are made to approach each other in accurate alignment by the use of special set-screws which have a long tapered sur-

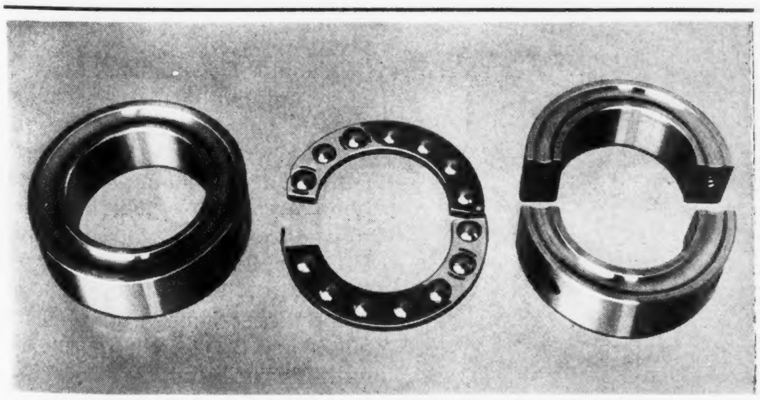


Fig. 2. A Ball Thrust Bearing in which Both Races and the Cage are in Two Pieces to Permit Convenient Assembly

face that engages a corresponding seat in both halves. This eliminates the need for any skill in sensing the correct register. The tapered hole is, of course, machined in the races before they are split. Because of the manner in which split radial bearings are assembled, a larger number of balls can be used than in a ball bearing with solid races.

The end of the inner race seen projecting from the large bearing is in the form of a three-lobe cam. This cam serves as part of a self-tightening locking device which is supplied when the shaft on which the bearing is to be used is of commercial cold-rolled steel. The cam engages a split cast-iron collar which can be rigidly mounted on shafts that vary considerably in size. This collar contains a recess with a contour that conforms to the cam. Any tendency for the inner race to slip, relative to the shaft, causes the cam to tighten within this recess, and this, in turn, by a tilting action, increases the grip of the collar on the shaft itself.

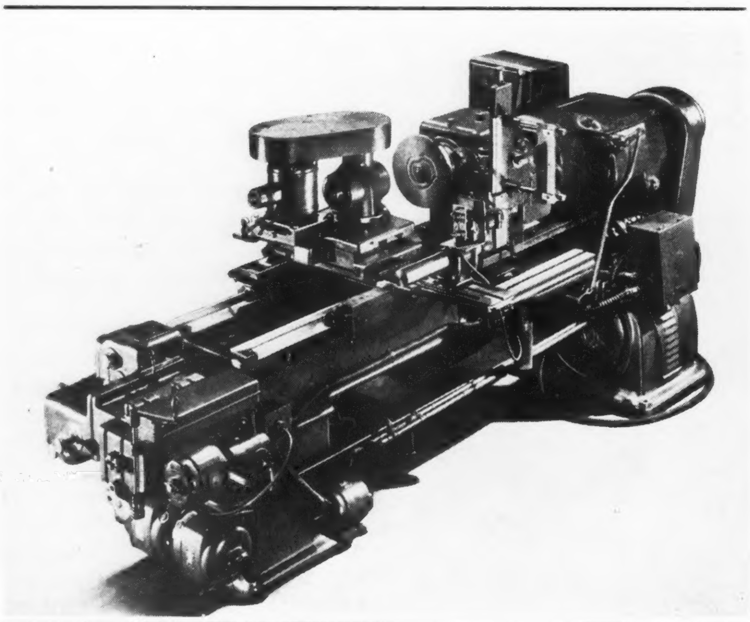
The construction of the thrust ball bearings made by the concern will be apparent from Fig. 2. The balls are contained in a two-piece cage that may be hinged, as illustrated, or bolted together. Both races are split as shown at the right, and they are assembled by tapered set-screws in the same manner as the races of the radial type bearings.

Split ball and roller bearings of both the radial and thrust types are made in standard sizes. This company also specializes in both solid and split bearings to meet unusual requirements.

Monarch Cam-Milling Attachment

A cam-milling attachment has recently been developed by the Monarch Machine Tool Co., Sidney, Ohio, for application to the Monarch-Keller controlled lathe. When used in combination with the Centrode device and oval chuck described in March, 1933, MACHINERY, page 494, the new attachment makes this lathe a universal machine for performing a wide range of operations.

The cam-milling attachment consists of a sub-headstock which is bolted on the lathe bed directly in front of the regular headstock, as illustrated. The attachment is driven through a silent chain by a sprocket that is bolted to the flanged spindle nose of the regular headstock. A complete universal milling fixture is mounted on the carriage in place of the regular compound rest. This attachment is adapted to milling face cams, single- or double-track cams, barrel cams, and other irregular-contour work, the operation being controlled from a master templet. Face cams 23 inches in diameter and barrel cams 12 inches in diameter can be produced.



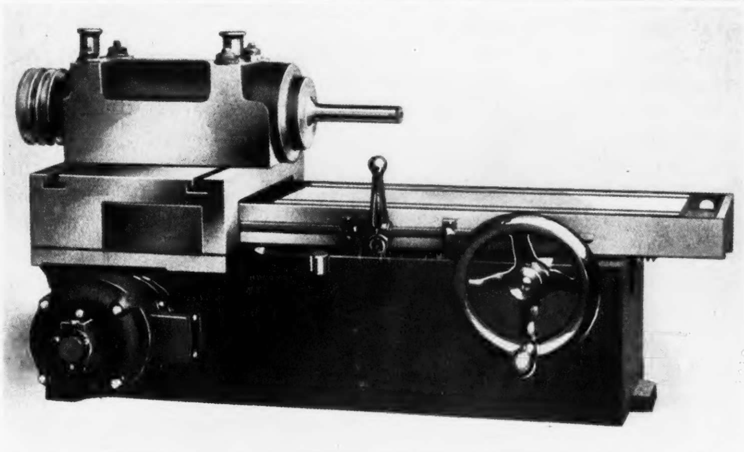
Cam-milling Attachment Applied to the Monarch-Keller Controlled Lathe

The templets are made 12 inches long, of 1/16-inch thick sheet zinc or other soft metal. They are laid out in a flat plane and travel their length, or 12 inches, during one revolution of the work. When the work has made a complete revolution, a precision contactor switch disconnects the current from a magnet clutch that drives the milling headstock spindle and thereby stops the machine automatically.

The milling headstock has a worm-driven spindle that runs at a 450-to-1 reduction from the speeds provided by the main headstock. The spindle nose on the milling headstock is identical with the flanged nose on the headstock proper, so that all chucks, plates, and fixtures can be readily interchanged.

It takes only a few minutes to mount the cam-milling attachment on the machine and make it ready for production or to remove the attachment and make the machine available for automatic turning or regular engine lathe work.

The milling spindle of the carriage unit can be swiveled to any angle. This spindle is driven by a one-horsepower alternating current motor, mounted vertically on a movable bracket attached to the carriage. Three-groove, V-belt pulleys are provided for this drive. The pulleys can be readily interchanged between the motor and the spindle to give six milling speeds ranging from 200 to 1700 revolutions per minute. This machine has a swing over the bed at the milling headstock of 28 1/2 inches.



Simplex Precision Boring Machine which Uses Carbide or Diamond Tools

Simplex Precision Boring Machine

The Stokerunit Corporation, 5325 W. Rogers St., Milwaukee, Wis., has recently developed a machine for boring operations in which accuracy and high output are desired. The machine is designed for boring with carbide or diamond tools. Quick-acting fixtures can be applied to the table for holding a large variety of work. Bores of various diameters can be finished through the provision of an accurate adjustment.

Two spindle heads may be mounted on the bridge at the left-hand end of the machine, if desired. The minimum and maximum distances between the centers of the two heads are 5 and 9 inches, respectively, while the distance from the center line of the spindles to the top of the table is 4 inches. The table has a feeding length of 9 inches.

The motor at the front of the machine provides power for feeding the table and the work to the boring-tool spindle. A second motor mounted on the bench behind the machine drives the spindle through V-belts. With the work in position in the fixture, the handwheel is turned to advance the table and work to the boring-tool spindle. Then the operator pushes a button to start both motors. Next, he moves the vertical lever near the middle of the machine, which causes the table to be fed forward by a lead-screw for the actual boring. When the end of the bore is reached, a dog trips an electric switch and stops both the feeding of the table and the rotation of the spindle.

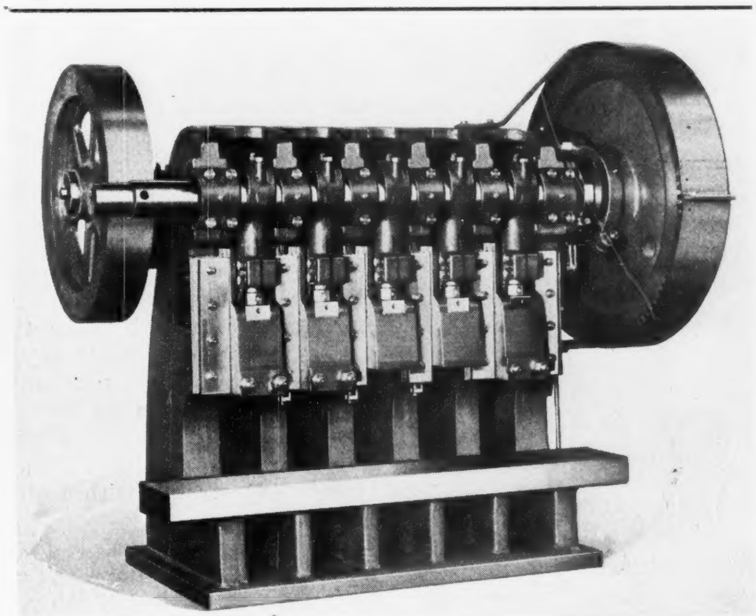
A speed of about 3400 revolutions per minute is considered normal for the spindle, although in tests, it has been run for extended periods at speeds as high as 7200 revolutions per minute. Pick-off gears provide spindle speeds to meet requirements. The spindle is mounted at the front in an adjustable bronze bearing that is surrounded by air ducts. A fan enclosed in the boring head draws air from the back of the machine and circulates it through the ducts to prevent the bearing from overheating. A double-row ball bearing is supplied for the rear end of the spindle.

This machine has an over-all length of 30 inches, and a net weight of 410 pounds.

Rockford Five-Slide Press

A press having five slides that are operated from one crankshaft has recently been built by the Rockford Iron Works, Rockford, Ill. Each of these slides is an independent unit having its own adjustment. As may be seen from the illustration, three of the slides were made for the conventional type of punch-holder, while the other two are shorter to suit special work.

One of the advantages of this machine is that small parts can



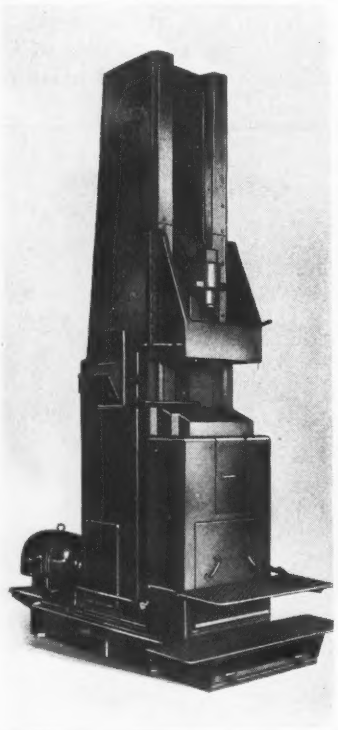
Rockford Press with Five Independent Slides Operated by One Crankshaft

be moved from one die to another for performing operations in sequence. Set-up time can be saved by leaving the dies in the machine. Connections, screws, rams, flywheels, and the clutch are standard parts of the Nos. 1 and 2 inclinable presses built by the concern. This press is also available with two, three, or four slides, in either flywheel or geared types.

American Hydraulic Broaching Machines

Broaches up to 68 inches in length and 8 inches in diameter can be handled by the machine here illustrated, which has been added to the regular line of automatic and semi-automatic broaching machines built by the American Broach & Machine Co., Ann Arbor, Mich. Obviously, the operator could not conveniently handle broaches of such dimensions, and so the machine is designed to take this burden entirely off the operator.

In the cycle of operations, the work is first placed over the end of the broach shank which projects through the angular table. When the machine is started, the broach is raised by a hydraulic elevator and is automatically connected to a head on the lower end of the pulling ram. As the ram moves upward through the application of hydraulic pressure, it pulls the broach through the work. When the lower end of the broach has passed through the work, the completed piece slides down a chute. Automatic stop-dogs can be set for any desired length of stroke.



American Broaching Machine for Tools up to 68 by 8 Inches

The machine is direct-driven by a 25-horsepower motor. The cylinder is 13 inches in diameter, and the ram 6 1/2 inches in diameter. The high-pressure pump operates at 1200 revolutions per minute. The maximum cutting speed of the machine is 18 feet a minute, and the return speed, 24 feet a minute.

The same concern has also recently brought out a utility press that is built in capacities of 25 and 50 tons for general-purpose and production work. This machine is also self-contained, being equipped with a high-pressure hydraulic pumping system and a balanced piston valve for controlling the ram movements. The ram always returns to the upper or starting position after each cutting stroke. It is operated by a foot-pedal and hand-lever.

The 25-ton machine has a downward speed of 18 feet a minute and a return stroke at the rate of 22 feet a minute. The maximum distance between the ram and the base table is 62 inches, while the maximum length of stroke is 36 inches. Stop-collars are provided for automatically obtaining any length of stroke within the range.

The 50-ton press has a down stroke of 9 feet a minute and an up stroke of 12 feet a minute. The 25-ton press weighs 8000 pounds, and the larger size 9000 pounds.

Lees-Bradner Gear Tester

Both spur and helical gears can be inspected for tooth contour, arc of action, length of line of action, tooth-to-tooth spacing, cumulative error, and eccentricity by a new gear testing machine that is being introduced to the trade by the Lees-Bradner Co., Cleveland, Ohio. Either side of the involute curve can be checked without changing arbors, levers, or turning gears over by simply shifting a contact point to the other side of the tooth. There is one attachment for testing tooth spacing and eccentricity and another for testing tooth contour. Direct-reading indicators record plus or minus variations in tenths of a thousandth.

This gear tester is designed to employ the base circle of any given gear and reproduce the tooth curve of that gear by rolling a tangent line upon the base circle and marking the path of any point in the tangent line. There is provision for holding a

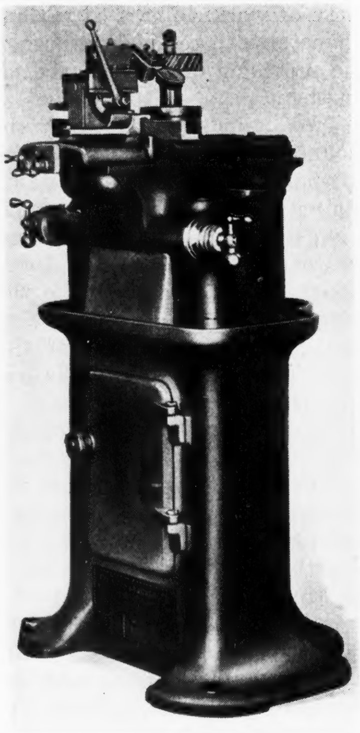


Fig. 1. Lees-Bradner Spur and Helical Gear Testing Machine

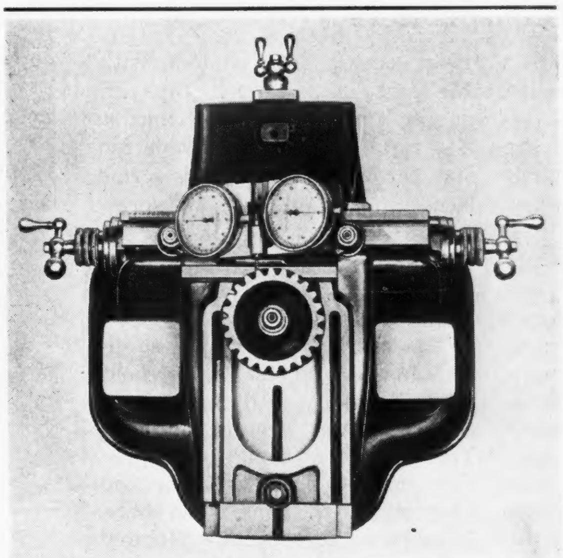


Fig. 2. The Tooth Contour Indicators are Mounted on a Tilting Member

straightedge against the base circle with sufficient pressure to insure that it will roll upon the base circle without slippage. Mounted on the straightedge is a lever with a contact surface intersecting the face of the straightedge. When the base circle is rotated, the contact lever traces the involute curve.

Any movement of the contact lever away from the true involute curve is registered by indicators which read to plus or minus 0.0001 inch. The tooth contour indicators are mounted on a tilting member, as illustrated in Fig. 2, and locked in any desired position within the limits of the machine. A graduation on the straightedge carrier indicates upon the graduated scale of a cross-rail the distance that the straightedge has been rolled on the base circle; this shows when the contact lever reaches certain successive positions on the involute curve and also measures the length of the line of action.

For testing the tooth curve, the indicator is set up at zero when the contactor touches the gear tooth at the base of the circle or at the working depth of the tool. The graduation on the straightedge carrier points to zero on the scale of the cross-rail when the contact lever is at the base circle, but when the teeth are not deep enough to reach the circle, readings start a little distance from zero.

This method of inspection permits a standard of accuracy to be established that is based on the true involute, so that it is easy to determine whether or not any gear out of regular production is accurate within the specified limits.

Provision has been made for simultaneously checking tooth-to-tooth spacing and eccentricity. The space testing device consists of a base which is mounted on the machine. It is equipped with a lever-actuated slide that is movable radially in relation to the gear being tested. A movement of the lever in one direction retracts the slide, and when the lever is released, the slide is restored to its initial position by a compression spring. Located on this slide is a carrier which is adjustable radially to suit gears of various pitches. Trunnioned therein is an angularly adjustable member that can be locked in position. This swiveling member is bored to receive a conical tooth-engaging member that can be interchanged to suit gears of different pitches and pressure angles.

The swiveling member also carries a contactor for tooth spacing and an indicator for detecting errors in the spacing. It is adjustable to suit gears with helical angles up to 50 degrees, right- or left-hand.

In operation, the cone is fully engaged in a tooth space of the gear and the eccentricity indicator is set to zero. The lever on the fixture is then pulled toward the operator to withdraw both the cone and the contactor, after which the gear is rotated through the space of one circular pitch and the handle gently released to allow the tooth contactors to engage the gear under spring pressure. This arrangement insures uniform pressure on the contactors.

Armstrong Star Drills

Four-point star drills drop-forged from a special high-carbon chisel steel, hardened and tempered, have been added to the line of tools manufactured by the Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill. These drills are finished in black baked enamel and the edges are ground bright. The shanks are of the proper stiffness to prevent bending.

These drills are made in practically all sizes. Diameters from 1/4 to 1 inch, inclusive, are available in increments varying by 1/16 inch, and in lengths of 8, 12, 18, and 24 inches. Larger diameters, from 1 to 1 1/2 inches, inclusive, varying by increments of 1/8 inch, are provided in lengths of 12, 18, and 24 inches.

Solenoid Type Automatic Motor Starters

Solenoid type, automatic motor starters, the contactor of which cannot be accidentally closed by vibration, have recently been developed by the Square D Co., 710 S. Third St., Milwaukee, Wis. These starters have a vertical straight-line action. Flexible leads have been eliminated.

The thermal overload relays are mounted on the front of the panel, where they can be easily interchanged. Push-buttons 1 inch in diameter are supplied on the cover. These starters have maximum polyphase ratings of 5 horsepower, 220 volts; and 7 1/2 horsepower, 440 or 550 volts. They are also built with a four-pole contactor for two-phase service.

Landis Collapsible Taps

The Landis Machine Co., Inc., Waynesboro, Pa., is introducing on the market a new line of collapsible taps to supersede the company's former Victor line. The new taps are made in two types. The Style LT, shown in Fig. 1, is designed primarily for straight tapping, but it can be successfully used for tapping tapered threads of a length not exceeding the American tapered pipe standards. The Style LM, shown in Fig. 2, is of a receding-chaser design and is intended for taper tapping. The receding-chaser action minimizes cutting strains on this class of work, with the result that greater accuracy and longer chaser life are obtained. Both styles can be used either as stationary or rotary taps.

The main feature of these new taps is a patented design consisting of two units: First, a body that contains the operating mechanisms; and second, a head in which the chasers are supported. The advantage of this design is that it permits the use of one body to cover a wide diameter range by applying heads of various sizes. In addition, the same body can be used for either right- or left-hand tapping, provided right- and left-hand heads are employed.

The collapsing mechanism of these taps is positive in action, both with respect to locking the chasers in the cutting position and in its collapsing action. The collapsing action is obtained through a hardened steel trip ring coming into contact with the part being tapped, thus insuring uniform thread lengths. The tap heads are adjustable for size through an adjusting screw located in the plunger. This screw is self-locking and is of the ratchet type. Turning the screw one notch gives a chaser adjustment of 0.001 inch.

The chasers are supported in slots in the tap head and are held securely in tapered seats in a hardened and ground plunger. The plunger is designed to provide maximum rigidity for the chasers. At the same time, there is no tendency for the plunger to rotate under cutting strains and thereby force the chasers out of alignment. All locating surfaces of the chasers, as well as the thread form itself, are precision ground.

Style LT taps are made in five sizes which, when equipped with the proper heads, cover a combined range of from 1 1/4 to 13 1/4 inches, inclusive. Style LM taps are also made in five sizes, covering a combined range of from 1 1/4- to 12-inch pipe, or from 1 1/2 to 13 3/8 inches in diameter, inclusive.

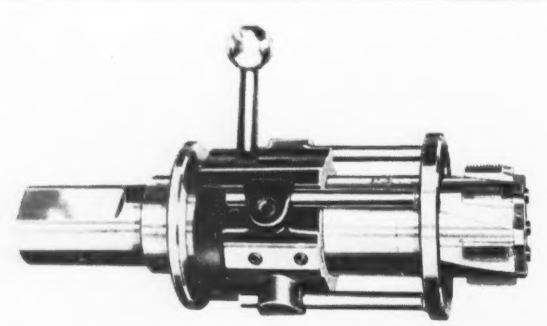


Fig. 1. Landis Style LT Collapsible Tap for Straight or Taper Holes

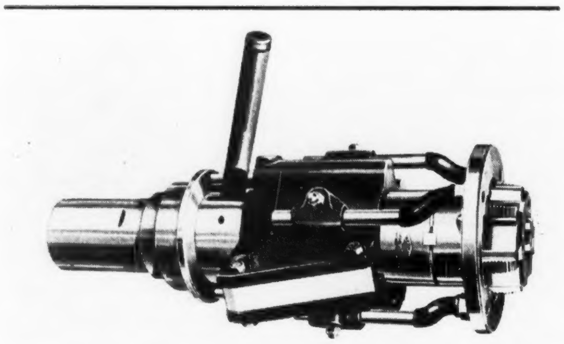


Fig. 2. Landis Style LM Receding-chaser Collapsible Tap for Taper Holes

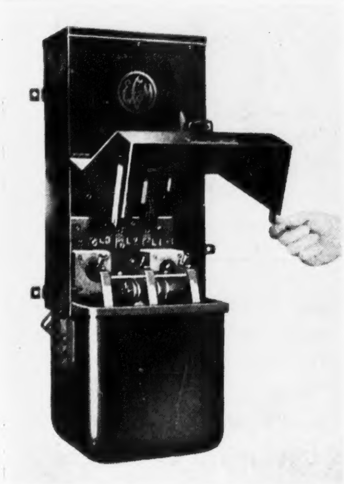
Electric Erasing Machine

An electric erasing machine that is held like a pencil is being introduced on the market by the Charles Bruning Co., Inc., 102 Reade St., New York City, and 445 Plymouth St., Chicago, Ill. The manner of holding the device enables a draftsman to maintain an accurate finger control when erasing pen or pencil lines on tracings or drawings. The machine is operated by a self-contained electric motor which runs on both 110-volt alternating and direct current. Lightness, compactness, and moderate cost are the advantages claimed.

Electric Erasing Machine Held Like a Pencil

Across-the-Line Magnetic Starter for Large Motors

Motors up to 30 horsepower, 220 volts; 60 horsepower, 440 volts; and 75 horsepower, 550 volts can be equipped with a No. 2 Type ZOS oil-immersed, across-the-line combination magnetic starter recently developed



Oil-immersed Across-the-line Combination Magnetic Starter

by the Electric Controller & Mfg. Co., 2708 E. 79th St., Cleveland, Ohio. This starter is a companion to the No. 1 described in October, 1933, MACHINERY, page 122, but of larger size. It contains an unfused or fusible safety switch and a magnetic starter with overload relays.

Although designed for severe mill duty, this starter is very small and narrow. It has a front-operated safety switch and a cover that swings vertically.

Gear-Motor with a Reduction Unit at Each End

The wide variety of modifications obtainable in the line of gear-motors manufactured by the General Electric Co., 10 Canal St., Schenectady, N. Y., is illustrated by the unit here shown. This gear-motor is made with a single reduction unit at each end and with double shaft extensions. With this construction, the same or different reductions in speed can be obtained at the two ends of the gear-motor, or the full-load motor speed can be furnished at one end and a reduced speed at the other. The total horsepower taken from the two shaft extensions must, of course, not exceed the motor rating.

Detroit Rocking Electric Furnace of Small Capacity

A rocking electric furnace of from 25 to 100 tons capacity has been brought out by the Detroit Electric Furnace Co., 825 W. Elizabeth St., Detroit, Mich. This furnace has been designed for either production use or for the experimental melting of small runs of such metals as iron, alloy steel, copper, brass, nickel, aluminum, and precious metals.

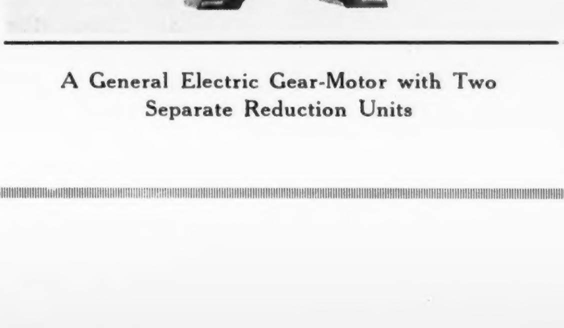
The furnace is of the same design as the larger rocking furnaces built by the concern and it provides the same advantages as to speed, economy, and analysis control. It is completely equipped with a transformer, a control panel, switches, meters, and a rocking mechanism. The nominal electric rating is 20 kilowatts. This furnace can be connected to any industrial power supply.

Wicaco Water-Cooled Internal Grinder Head

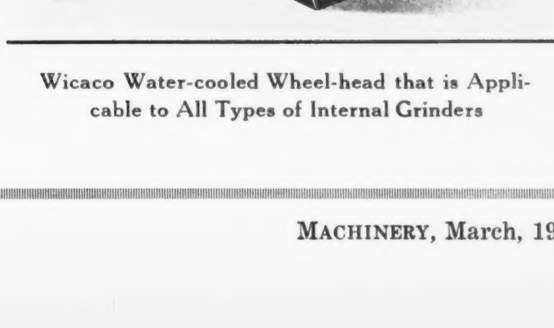
A water-cooled wheel-head for internal grinding machines, which has been used for seven years in the shop of the Wicaco Machine Corporation, Stenton Ave. and Louden St., Philadelphia, Pa., and which has been supplied on the precision internal grinder built by that company, has now been made available for application on all internal grinders.

The oil chamber and bearings of this grinding-wheel head are surrounded by a cooling jacket through which the ordinary grinding coolant is pumped continuously. This design permits constant operation of the grinding head with no appreciable rise in the bearing temperature. It is also said to maintain the lubricant at the desired viscosity and to eliminate chatter by holding wear of the bearing surfaces to a minimum.

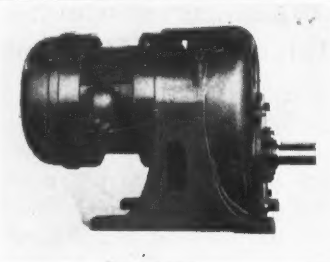
The spindle is so constructed that the ball bearings absorb just a sufficient amount of heat for efficient operation without chatter. The spindle is designed to rest completely within the bed of the cross-slide in such a way that torque or spring, which might result in bell-mouthed holes, is eliminated. These heads are furnished with either a quill or solid type of spindle, and in three sizes. Maximum spindle speeds of from 10,000 to 25,000 revolutions per minute are obtainable with the different sized heads.



A General Electric Gear-Motor with Two Separate Reduction Units



Wicaco Water-cooled Wheel-head that is Applicable to All Types of Internal Grinders



Reliance Gearmotor with Single Pair of Gears

Reliance Single-Reduction Gearmotors

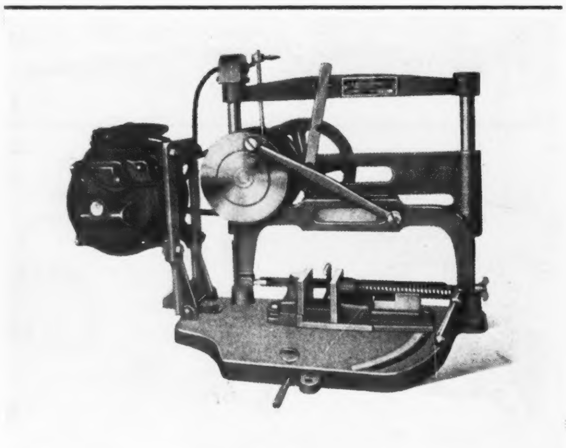
Single-reduction units have recently been added to the line of gearmotors manufactured by the Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Road, Cleveland, Ohio. These single-reduction units are for ratios up to 6 to 1, inclusive. They can be furnished with both alternating- and direct-current motors of various types, rated from 3/4 horsepower upward. Multi-speed and adjustable-speed motors can be supplied.

In these units the entire reduction is obtained with a single pair of gears. Substantial feet cast integral with the gear housing afford a solid support close to the point of maximum torque application. Ball bearings are used throughout. The motor parts and gears can be readily removed and reassembled, and the user can easily make a change in the reduction ratio, if this should be desired.

Rodgers Precision Bench Hacksaw

Round and square stock up to 3 inches can be handled on a precision bench hacksaw recently placed on the market by the R. B. Rodgers Mfg. Co., 2381 E. 27th St., Los Angeles, Calif. This equipment is mounted on a base 12 by 19 inches, and complete with motor, weighs only 58 pounds, so that it is readily portable. The motor is of 1/6 horsepower rating and operates on 110-volt alternating current. The stroke is 4 inches.

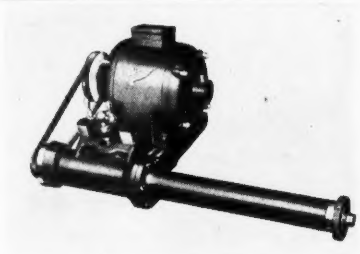
One of the features of this machine is that it employs high-speed hand-frame blades. A uniform feed pressure is applied during the entire cut. An automatic switch stops the machine when the cut is completed or at any desired depth of cut. The vise swings to an angle of 45 degrees. Vertical guide posts and a steel-frame slide eliminate lost motion and vibration.



Portable Power Hacksaw in which Hand-frame Blades are Used

Gardner-Denver Vertical Compressors

Low initial, installation, and maintenance costs are advantages claimed for a new line of high-speed vertical water-cooled air compressors now being introduced on the market by the Gardner-Denver Co., Quincy, Ill. The inlet and discharge valves of these compressors are cushioned and silent in operation. Extra large water jackets surround the cylinders and valves to insure minimum temperatures. A water-cooled intercooler saves power and increases the volumetric efficiency by cooling the air between stages. Lubricant is supplied under pressure to all bearings by a rotary oil-pump. The oil lines are drilled passages.



Hisey Internal Grinder for Use on Lathes and Boring Mills

Hisey Internal Precision Grinders

Self-contained precision grinding units designed for performing internal grinding operations in the lathe or on the boring mill have been developed by the Hisey-Wolf Machine Co., Cincinnati, Ohio. They are made in four sizes—1/2, 1, 2, and 3 horsepower. While these grinders are suitable for many odd jobs that come up in the average shop, they are said to be equally satisfactory for production work, being constructed throughout for continuous-duty service.

The constant-speed motors with which these grinders are equipped operate at practically the same speed under any load within their rated capacity. Ordinary vitrified wheels can be used with safety. The grinders are designed to accommodate work up to the full swing of any lathe or boring mill. There is a convenient adjustment for moving the wheel to and from the center of the work. This adjustment is so designed that the belt tension is not affected.

Grinding can be done either at the right or left of the machine, since the grinding spindle, together with the motor, can be swung end for end. The direction of wheel rotation is reversible through the motor. These grinders can be used horizontally, vertically, or at any intermediate angle.

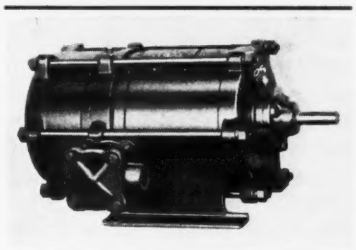
Louis Allis Explosion-Proof Self-Contained Capacitor Motors

One of a new line of single-phase, explosion-proof, self-contained capacitor motors being placed on the market by the Louis Allis Co., Milwaukee, Wis., is shown in the accompanying illustration. These motors are especially adapted for all Class 1, Group D hazardous locations. One of the features is a capacitor or condenser that is self-contained within the motor. A simple positive-acting switch cuts out the capacitor at a predetermined speed.

These motors are available at the present time in the non-ventilated type at ratings from 1/2 to 1 horsepower, and in the totally enclosed, fan-cooled type at ratings from 1 1/2 to 3 horsepower.

Twin Disc BFT Clutches

The Twin Disc Clutch Co., 1324 Racine St., Racine, Wis., has recently developed a line of clutches that combine in a single model all the advantages of the Models BF and T manufactured by the company. This new line is known as the BFT series. It is intended to cover practically all requirements for this type of



Single-phase Self-contained Capacitor Motor

clutch, the capacities ranging from 3 to 80 horsepower at 100 revolutions per minute.

Eight sizes, ranging from 6 1/2 to 24 inches, are included in the series. The sizes from 6 1/2 to 14 inches, inclusive, are made with one, two or three plates, while the larger sizes are made with either one or two plates, as required.

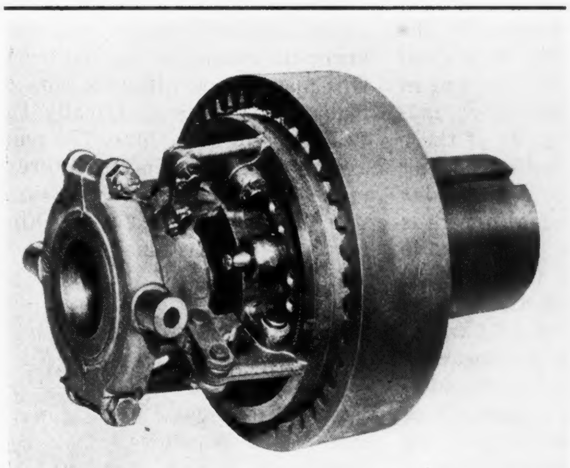
In order to make the line as complete as possible, the company has also developed driving spiders for all clutch sizes and for either one, two, or three plates. These spiders are available in three different styles and are all of the internal gear-tooth drive type. The clutches are of the toggle-action type. In addition to using gear-tooth driving plates, they have inner plates that take their drive from the hub. One of these clutches, with a spider, is shown in the accompanying illustration.

Vickers Balanced Gear Pump and Fluid Motor

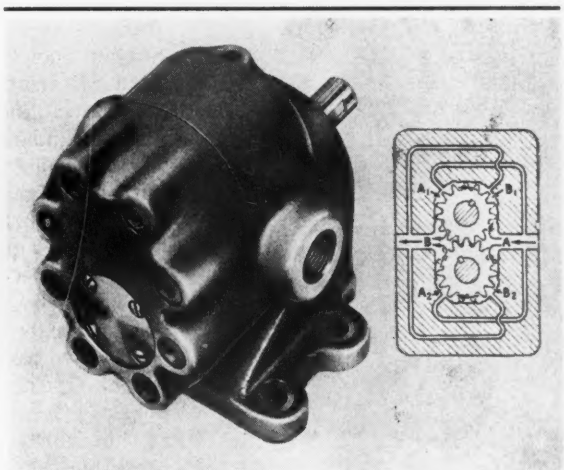
Hydraulic balancing is the feature of a unit recently developed and patented by Vickers, Inc., Detroit, Mich., for use either as a gear pump or as a fluid motor. The hydraulic balancing principle can be understood by reference to the cross-sectional drawing in the illustration. Adjacent to the gears and diametrically opposite the inlet chamber *A* are balancing chambers A_1 and A_2, which are connected to *A* and are open to the pressure in that chamber. Similarly, balancing chambers B_1 and B_2 are connected to outlet chamber *B* and are open to the pressure in that chamber.

Each gear is always in hydraulic balance, the design eliminating thrust loads and the consequent wear on bearings, gears, and housing which tends to increase slippage. Longer life, higher efficiency, and greater operating pressure are the advantages claimed. The unit cannot bind or lock. It can be started under full pressure as a motor and is reversible without any changes.

This device has been used as a motor for driving drills, grinding spindles, etc., in the Vickers plant for the last two years. It operates as a pump at pressures up to 1500 pounds per square inch.



Twin Disc Clutch which Combines the Advantages of the BF and T Models



Vickers Pump and Fluid Motor of a New Hydraulically Balanced Design

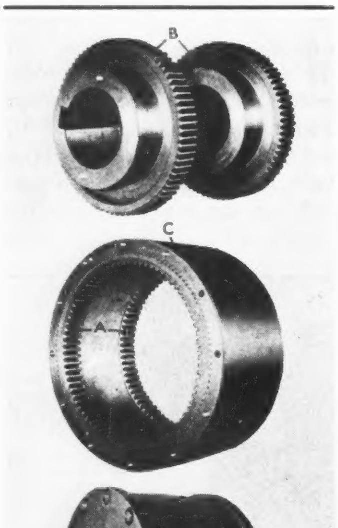
Waldron "Torque Ring" Coupling

Smith & Serrell, general sales agents, 62 Washington St., Newark, N. J., and the John Waldron Corporation, New Brunswick, N. J., have developed an all-steel lubricated gear type coupling to which the name "Torque Ring" has been given. This coupling is based on the principle of quadruple engagement. When the shafts connected by the coupling become misaligned, there are four points within the coupling at which relative movements can take place freely. Each torque ring *A* (see illustration) can tilt or slide endwise with respect to its hub member *B*, and both torque rings and hubs can also tilt or move endwise within a single-piece cover sleeve *C*. An assembled coupling is shown at the bottom of the accompanying illustration.

In this coupling, torque is carried by the lubricated surfaces of solid metal parts from hub to hub. The end plates simply form a dust- and moisture-proof enclosure with the center sleeve that contains a supply of oil adequate for long periods of operation. The hubs are made alike, with toothed flanges at the center. They can be turned end for end to obtain new driving surfaces, in case the original tooth faces become worn due to neglected lubrication.

Torque rings *A* are solid with teeth cut on the inside and outside. They are held loosely in place within the cover sleeve. By removing either end plate, the cover sleeve and the torque rings can be moved in the opposite direction. This is desirable in lining up initially or for subsequent checking of alignment from the faces of the inner hubs.

It is claimed that these torque ring couplings are especially suitable for use under conditions of heavy loads, heavy misalignments, shock, and vibration, such as are often encountered with heavy-duty direct-connected and geared motor or engine drives. The couplings are regularly made in fifteen sizes for shafts from 1 7/8 to 12 inches in diameter. The capacity ratings range from 22 1/2 to 4840 horsepower per 100 revolutions per minute.



"Torque Ring" Coupling with Quadruple Engagement Principle

Sutton Compensating Master Collets

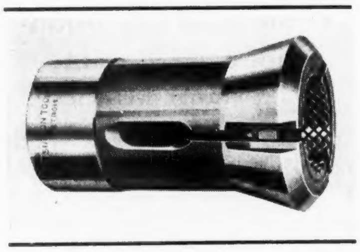


Fig. 1. Sutton Collet with Self-adjusting Feature

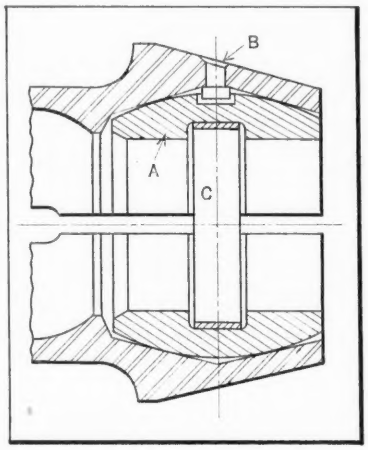


Fig. 2. Collet Design that Compensates for Stock Irregularities

Master collets with interchangeable and replaceable pads for holding the stock are being introduced on the market by the Sutton Tool Co., 2842 W. Grand Blvd., Detroit, Mich., for use in automatic and hand screw machines. Pads *A* (Fig. 2) of these Style G collets are self-adjusting within the master. An angular seat in the master and a radius on the back of the pads provide a two-line contact between the pads and the master, thus allowing the pads to rock in two directions to permit a true bearing on the stock. This feature compensates for surface inequalities of hot-rolled stock without decreasing the gripping power of the collet.

Pins *B* in the master engage blind holes in the pads and prevent the latter from rotating. A flat spring *C* holds the pads securely against the master. The spring recess in the pads is deep enough to keep the spring out of contact with the work.

The pads are made with diamond serrations, in order to develop an unusual gripping power under reduced tension and thus lower the chance of spoiled work. One master and different sets of pads will handle practically the full range of a machine. The pads are interchangeable on different makes of machines of the same size, but each different machine requires its own master.

Hedglon Automatic Oil and Coolant System

The Diefendorf Gear Corporation, 922 W. Belden Ave., Syracuse, N. Y., has developed an automatic electric system of supplying coolant to machine tools or oil under pressure to the bear-

ings of various types of machinery. This system is based on the use of a Hedglon gear type of pump which can be equipped, as illustrated in Fig. 1, with a pressure dome and an automatic pressure switch. The dome insures a constant pressure on the liquid being pumped. Thus, in a lubricating system, the switch automatically starts the motor when the pressure is reduced as the oil is used by rotating parts.

A pump unit is also made without the pressure dome and switch, as illustrated in Fig. 2, for use on small machines, the unit with the pressure dome and switch being intended for large machines or for batteries of six or more small machines equipped with a central tank. Both pump units are equipped with a 1/2-horsepower motor and have a capacity for delivering 250 gallons an hour.

Two bronze helical gears are the only revolving parts in these pump units. One of these gears is keyed direct to the extended motor shaft. The pump body is bolted to the motor frame. A patented mechanical seal eliminates the need of non-metallic packing or stuffing-boxes. In addition to the applications mentioned, these pumps can be used for circulating water, quenching oil, and other liquids.

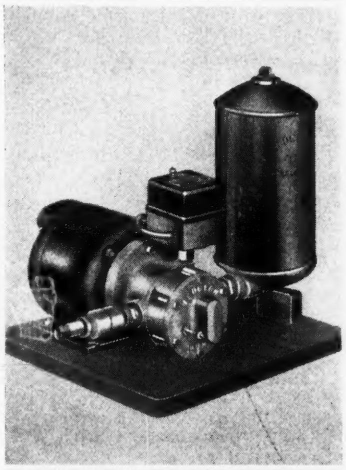


Fig. 1. Hedglon Pump Unit with Automatic Pressure Switch

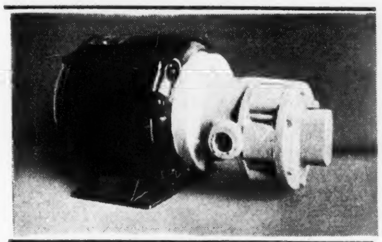


Fig. 2. Oil or Coolant Pump for Small Machine Tools

Heating Units for Polishing and Plating Baths

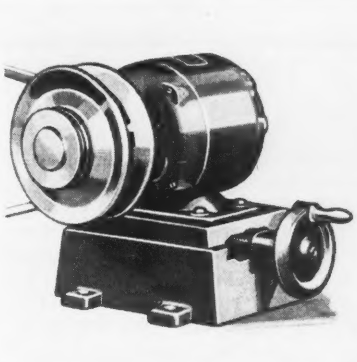
The General Electric Co., 10 Canal St., Schenectady, N. Y., has developed a lead-sheathed heating unit designed to retard the chemical action of corrosive solutions such as are used in pickling and plating baths. It contains a sheath-wire winding about which is cast a heavy block of lead. The unit has a density of only 13 watts per square inch of immersed surface, a factor that is believed to greatly prolong the life of the device.

The same company has also brought out a copper-sheathed unit which can be placed in almost any vessel containing water and plugged into an ordinary power circuit for heating the water. The vessel need not contain more than about 5 inches of water. This device has a rating of 1300 watts at 115 or 230 volts.

Another recent General Electric heating unit is made entirely of monel metal for heating linseed oil without staining it, when manufacturing ink, varnish, etc.

WHS Variable-Speed Pulley

The variable-speed pulley unit here illustrated has been added to the line of speed reducers and transmission equipment manufactured by Winfield H. Smith, Inc., Springville, Erie County, N. Y. This unit consists of two conical sections or half-pulleys that are driven by a motor. The half-pulleys have slots on their conical faces that permit them to interlock and give a positive



Variable-speed Unit with Adjustable Pulley

drive. Each half-pulley is mounted on a bushing having a spiral key that engages a groove in the pulley bore. The bushing is keyed to the motor shaft or held in place by means of a setscrew.

When the motor base is moved back and forth, the two half-pulleys are adjusted toward each other or apart, as the case may be, causing the belt to run on a smaller or a larger diameter of the pulley. This arrangement provides an infinite variation in speeds from minimum to maximum. The center of the half-pulleys is always in line with the center of the driven pulley, so that standard V-belts and a standard driven pulley can be used.

Rust spots can be removed from metal surfaces by applying Rust-I-Cide, a liquid manufactured by the Rusticide Products Co., 1943 E. 19th St., Cleveland, Ohio. This liquid is non-poisonous and harmless to the hands of the user. It can be employed to clean bright-finished parts or to clean surfaces prior to repainting.

* * *

"It may be all right, but it seems queer to me," said the Unconventional Economist, "that we are supposed to become more and more prosperous the less we work."

NEWS OF THE INDUSTRY

California

J. D. CHRISTIAN, ENGINEERS, 514 Brannan St., San Francisco, Calif., has been licensed by the Falk Corporation of Milwaukee, Wis., to manufacture Rite-Lo-Speed motors under the original Christian design. The Falk Corporation is the new owner of the patent originally issued to J. D. Christian. The standard motor units known as Series HD manufactured by the Christian organization are produced under pending patent applications owned exclusively by J. D. Christian.

Illinois and Indiana

ROBERT M. GAYLORD, president of the Ingersoll Milling Machine Co., Rockford, Ill., and LEO W. GROTHAUS, of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., have been elected members of the executive committee of the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill. The Institute has been the leader in the code deliberations of the capital goods industry of the country.

J. L. VAN NORT is now associated with the Chicago office of the Reliance Electric & Engineering Co., Cleveland, Ohio, as sales engineer. He previously represented the company in the New England and Cincinnati districts.

MCCLEAN MACHINERY CO., dealer in electric tools, gear generators, riveters, industrial diamonds, and multiple drill heads, has moved from 560 Washington Blvd., Chicago, Ill., to 30 N. Clinton St., Chicago.

CONNERSVILLE BLOWER CO., INC., Connersville, Ind., at the last annual meeting of the stockholders, took action to change the name of the company to ROOTS-CONNERSVILLE BLOWER CORPORATION. The management of the company will continue as heretofore.

Michigan

AMPCO TWIST DRILL CO., Jackson, Mich., at a recent directors' meeting, reelected F. J. SIKOROVSKY president and treasurer; E. R. YOUNG, vice-president; and C. L. JACOBS, secretary, all of whom have been connected with the company since its inception. Mr. Sikorovsky was formerly general superintendent of the Rich Tool Co. of Chicago, now the Wilcox-Rich Corporation. He has been with the Ampco Twist Drill Co. eleven years, entering the employ as factory manager, and in recent years serving as manager of sales and engineering.

KALES STAMPING CO., 1678 W. Lafayette Blvd., Detroit, Mich., maker of metal stampings and pressed-metal parts, has changed its name to the WHITEHEAD STAMPING CO. This change does not affect the policies nor the personnel of the company. The officers of the Whitehead Stamping Co. are: J. Frazer Whitehead, president; Thomas C. Whitehead, vice-president; and George W. Schreck, secretary.

ARTHUR R. FORS has been appointed general works manager of all the plants of the Continental Motors Corporation, including the plants in Detroit, Muskegon, and Grand Rapids, Mich. Mr. Fors became associated with the Continental Motors in 1912 as tool designer, and has since held the positions of master mechanic and production manager.

New Jersey

INGERSOLL-RAND CO., 11 Broadway, New York City, has acquired the turbo-blower business of the General Electric Co., Schenectady, N. Y., and will consolidate it with its own turbo-blower department. The Ingersoll-Rand Co. has also been granted an exclusive license under the various General Electric patents. The manufacturing equipment previously employed by the General Electric Co. is being moved to the Ingersoll-Rand plant at Phillipsburg, N. J., where all types and sizes of turbo-blowers will be manufactured.

HAROLD B. RESSLER, vice-president in charge of sales of Joseph T. Ryerson & Son, Inc., Chicago, Ill., will move to New York to take charge of the Jersey City plant of the company. He will take the place of J. A. MCNULTY, former manager of the Jersey City plant. Mr. Ressler has been connected with the company for thirty years, and, prior to moving to Chicago in 1929, was manager of the Ryerson St. Louis plant for fifteen years. He is also vice-president of the American Steel Warehouse Association.

CHARLES H. BAUER has been engaged as merchandising manager of the V-belt department of the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J. Mr. Bauer has had a long experience in this field.

New York

GENERAL ELECTRIC CO., 10 Canal St., Schenectady, N. Y., was presented, on February 1, with a gold medal by the American Institute of the City of New York "for pioneering in industrial research." The Council on Awards of the Institute has decided that the establishment and maintenance by the General Electric Co. of its large laboratory for pure research has been of lasting benefit to human progress and industry. The laboratory was created in 1900, when Dr. Willis R. Whitney went to Schenectady from the Massachusetts Institute of Technology to assume the position of research director for the company. Many of the scientific discoveries made there have greatly expanded existing industries, and, in some instances, have created several large new industries.

D. S. YOUNGHOLM has been elected vice-president of the Westinghouse Lamp Co., East Pittsburgh, Pa. Mr. Youngholm has been connected with the company for twenty-five years. He was previously assistant general superintendent and later became assistant to the vice-president, which position he held until his present election. His headquarters will be at 30 Rockefeller Plaza, New York City.

J. A. DOUCETT, formerly vice-president and general sales manager of Revere Copper & Brass, Inc., 230 Park Ave., New York City, has been appointed vice-president in charge of sales. C. A. MACFIE, formerly assistant sales manager, becomes general sales manager. Both Mr. Doucett and Mr. MacFie have had long experience in the copper and brass industry.

F. B. COYLE, metallurgist of the research department of the International Nickel Co., Inc., 67 Wall St., New York City, addressed the Springfield, Mass., section of the American Society for Metals (formerly the American Society for Steel Treating) February 26 on the subject "American Progress in the Use of Alloys in Cast Iron."

A. B. CLARK has been appointed general traffic manager of the operating companies of the Union Carbide and Carbon Corporation, 30 E. 42nd St., New York City, succeeding the late Herbert Thompson. Mr. Clark has been connected with the corporation seventeen years.

H. B. SMITH has been placed in charge of gas furnace sales activities of the merchandising division of the air conditioning department of the General Electric Co., 10 Canal St., Schenectady, N. Y., with offices in New York City.

FREDERICK C. DANNEMAN, of the F. C. Danneman Co., 203 Lafayette St., New York City, has been appointed a member of the General Technical Committee No. 9 on punch- and die-holders of the American Standards Association.

C. V. MURRAY has joined the New York branch of the Patterson Foundry & Machine Co., East Liverpool, Ohio. Mr. Murray was, for thirteen years, sales engineer for the Robinson Mfg. Co. of Muncy, Pa. He will make his headquarters at 30 Church St., New York City.

Lockwood Greene Engineers, Inc., announce the removal of their New York executive office from 100 E. 42nd St. to 30 Rockefeller Plaza, and their Boston office from 24 Federal to 40 Central St.

A. G. Pratt, president of the Babcock & Wilcox Co., New York City, has been elected a member of the board of directors of the Worthington Pump & Machinery Corporation, Harrison, N. J.

Carpenter Steel Co., Reading, Pa., has moved its New York sales office and Welded Alloy Tube Division to the Equitable Trust Bldg., 347 Madison Ave., New York City.

Air Reduction Sales Co., 60 E. 42nd St., New York City, has acquired the capital stock of the Wilson Welder & Metals Co. of North Bergen, N. J.

Ohio

C. S. Stilwell, sales manager of the Warner & Swasey Co., Cleveland, Ohio, was elected a member of the board of directors at the last annual meeting. Mr. Stilwell has been associated with the company since his graduation from Denison University in 1912. He attended the special apprentice school operated by the company for one year and then became a salesman in the Chicago office.

C. S. Stilwell, Recently Elected Member of the Board of the Warner & Swasey Co.

From 1914 to 1930 he was district manager, with headquarters in Detroit, and went from there to Cleveland to act as sales manager.

W. F. Gradolph, general sales manager of the DeVilbiss Co., Toledo, Ohio, manufacturer of air compressors and spray-painting equipment, sailed February 3 on the *Rex* for a month's business trip through Europe. He will visit the European agents of the company on the Continent and the DeVilbiss French and English subsidiaries in Paris and London. Mr. Gradolph will land in Naples, and from there go to Austria, Czechoslovakia, Germany, France, and England. He will return on the *Europa*, sailing March 10.

J. Wallace Carrel, vice-president and general manager of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, celebrated on February 1 the twenty-fifth anniversary of his connection with the company.

J. Wallace Carrel, Vice-president and General Manager of the Lodge & Shipley Machine Tool Co.

Clarence A. Young has become associated with the sales department of the Machined Steel Casting Co., Alliance, Ohio. His headquarters have been established at Alliance, from where he will operate in the Pittsburgh and Youngstown territories, specializing on the sale of rolling mill equipment and other heavy castings. Mr. Young was connected in executive capacities for many years with the Lewis Foundry & Machine Co. and the Duquesne Steel Foundry Co.

Warner & Swasey Co., Cleveland, Ohio, held a two-day sales conference in January at which the company's representatives from all over the country gathered to discuss business conditions and the sales outlook for the year. Considerable optimism was expressed regarding general business conditions. The reports indicated an upturn in a score of the nation's leading industrial lines.

Hydraulic Press Mfg. Co., Mount Gilead, Ohio, at a recent meeting of the board of directors, elected Frank B. MacMillin president and general manager of the company, and Howard F. MacMillin vice-president and assistant general manager. Walter G. Tucker, son of the founder of the company, was advanced from the presidency to the position of chairman of the board of directors.

Henry M. Halsted, Jr., has been made executive vice-president of the Gray Iron Founders Society, and together with Arthur J. Tuscany, executive secretary, will have charge of the administration and organization of the gray iron jobbing foundry industry, under the code submitted to the President. The offices of the Gray Iron Founders Society will remain in Cleveland.

Bantam Ball Bearing Co., 3400 W. Sample St., South Bend, Ind., announces that A. S. Hellstrom is now representing the company in the Youngstown, Cleveland, and Wheeling districts. Mr. Hellstrom is located at the Ohio Apartments, 1625 Ohio Ave., Youngstown, Ohio. He will handle the sale of ball and roller bearings for steel mills and steel mill equipment.

F. E. Harrell has been made assistant chief engineer of the Reliance Electric & Engineering Co., Cleveland, Ohio, manufacturer of electric motors. He has been connected with the Reliance organization since his graduation from Purdue University in 1924.

Pennsylvania and Maryland

Landis Machine Co., Inc., Waynesboro, Pa., announces that its Victor Plant, also located in Waynesboro, will henceforth be known as Landis Machine Co., Tap Division. This change in name has been brought about by the fact that the new line of collapsible taps recently placed on the market will be known as "Landis collapsible taps." The manufacture of the older line of Victor taps has been discontinued, being superseded entirely by Landis taps of the newer design.

E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa., manufacturer of oils and mechanical leather goods, elected the following officers at the last meeting of the stockholders: President, Louis E. Murphy; vice-president and general manager, Major Aaron E. Carpenter; second vice-president and director of sales, George W. Pressell; secretary, A. E. Carpenter, III; and treasurer, Dr. R. H. Patch.

Arthur E. Allen, formerly vice-president of the Westinghouse Lamp Co., has been elected vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., in charge of the merchandising division. Mr. Allen will have charge of all sales, manufacturing, and engineering activities of this new division. He has been connected with the concern since 1902.

Poole Foundry & Machine Co., 3701 Clipper Mill Road, Woodberry, Baltimore, Md., announces the appointment

of the J-B ENGINEERING SALES Co., New Haven, Conn., as representative for the sale of Poole flexible couplings in the state of Connecticut. It is also announced that FRANK M. YOUNG, 2636 N. 48th St., Milwaukee, Wis., has been appointed representative in Milwaukee and vicinity.

Wisconsin

C. R. MESSINGER, chairman of the board of the Chain Belt Co., Milwaukee, Wis., has resumed the post of president of the company, left vacant by the sudden death of his brother, Clifford F. Messinger, in December. For the last three years C. R. Messinger has been president of the Oliver Farm Equipment Co. and was recently elected chairman of the board of that company. G. K. VIALL, a vice-president, was elected to the vacancy on the Chain Belt board created by the death of Clifford F. Messinger. He has been with the company since 1921, serving successively as assistant to president, works manager, and vice-president.

HARNISCHFEGER CORPORATION, Milwaukee, Wis., has established group life insurance totaling about $587,000, combined with group sickness and accident protection, for its employes. The group program, which is being underwritten by the Metropolitan Life Insurance Co., is cooperative, employer and employes sharing the cost.

CALENDARS

NEW DEPARTURE MFG. Co., Bristol, Conn., manufacturer of ball bearings.

CINCINNATI MILLING MACHINE Co., and CINCINNATI GRINDERS, INC., Cincinnati, Ohio. Calendar commemorating the fiftieth anniversary of the company.

* * *

The Special Tool, Die and Machine Shop Institute Meets

The recently formed Special Tool, Die and Machine Shop Institute held its first national meeting at Cleveland, February 5. The following officers were elected: J. J. Kohl, Dayton, Ohio, president; H. A. Stoddard, New York City, vice-president; G. A. Barth, Cleveland, Ohio, secretary-treasurer; Roy T. Wise, 7016 Euclid Ave., Cleveland, Ohio, managing director. The Institute now has five hundred active members. A report on the Institute's code was presented by F. S. Blackall, Jr., Woonsocket, R. I., who mentioned that the code had been approved.

OBITUARIES

Harry H. Wyatt

Harry H. Wyatt, vice-president of the Detroit Alloy Steel Co. and secretary-treasurer of the Detroit Gray Iron Foundry Co., died January 28, at the age of forty-eight years. Mr. Wyatt was born on June 10, 1885, in Warick, England, and came to this country at the age of three. After being educated in Omaha, Neb., he moved to Detroit, and in 1906, entered the employ of Parke, Davis & Co., where he remained five years, after which he became associated with the Security Trust Co. as public accountant.

Harry H. Wyatt

In 1918, he joined the Detroit Gray Iron Foundry Co. as secretary and treasurer, which position he held until his death. He also served as director of that company, as well as of the Detroit Alloy Steel Co.

S. WEIL, engineer and representative of Schiess-Defries A. G., Germany, and for several years a contributor to MACHINERY, died January 6 at Frankfurt a/M. Mr. Weil was born in 1864 in Austria, and graduated from the Technical College at Vienna. Following his graduation, he devoted almost his entire life to the firm of Schiess-Defries A. G., Düsseldorf, where for nearly forty years he occupied the position of chief of the engineering department.

During this period he trained hundreds of young engineers and was actively engaged in the design of almost every heavy machine tool built by this firm for many years. In 1918 he became representative of Schiess-Defries for southern Germany. He was also technical advisor to a number of other firms.

Mr. Weil was well known as a contributor to engineering magazines all over the world. Some eight hundred technical articles from his pen have appeared in German, American, British, French, and Russian technical journals.

FRANK W. KENNEDY, vice-president and general manager of the De Laval Steam Turbine Co., Trenton, N. J., died at his home in Yardley, Pa., on January 24, after a short illness. Mr. Kennedy was born at Pittsburgh, Pa., in 1876 and attended the Shadyside Academy of that city. He graduated from Princeton University with the degree of Civil Engineer in 1898, after which he held positions successively with the Pennsylvania Railroad at Altoona, with one of the Ohio subsidiaries of the U. S. Steel Corporation, and with the Dravo-Doyle Co. at Pittsburgh. In 1908, he became general manager of the De Laval Steam Turbine Co. and in 1916 was elected vice-president. He was a director of that company and also president and director of the American Bauer-Wach Corporation of New York. He was a member of the Society of Naval Architects and Marine Engineers and the Machinery Builders' Society.

COMING EVENTS

MARCH 7—Regional meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Washington, D. C. Secretary-treasurer, C. L. Warwick, 260 S. Broad St., Philadelphia, Pa.

MARCH 12-16—Fourth annual PACKAGING EXPOSITION at the Hotel Astor, New York City, under the auspices of the AMERICAN MANAGEMENT ASSOCIATION, 232 Madison Ave., New York City.

JUNE 25-28—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Denver, Colo., with headquarters at the Cosmopolitan Hotel. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 25-29—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia.

JULY 3-9—FOURTH INTERNATIONAL CONGRESS FOR APPLIED MECHANICS to be held at Cambridge, England. For detailed information, address Applied Mechanics Division, American Society of Mechanical Engineers, 29 W. 39th St., New York.

OCTOBER 1-5—NATIONAL METAL CONGRESS AND EXPOSITION, Commerce Hall, Port of Authority Bldg., New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, director.

James Hartness, A Pioneer in the Machine Tool Industry, Passes

James Hartness, former president of the Jones & Lamson Machine Co., Springfield, Vt., past-president of the American Society of Mechanical Engineers, and sixty-first Governor of Vermont, died on February 2 at his home in Springfield at the age of seventy-two years. He was born in Schenectady, N. Y., on September 3, 1861. His father, John Williams Hartness, was a machinist. James Hartness followed his father into the machine shop at the age of sixteen, his first wage amounting to 45 cents per nine-hour day!

In 1882, when he was twenty-one years old, he obtained, through the interchange of letters, a position as foreman. The shop was a newly organized bolt and nut plant in Winsted, Conn. When young James presented himself to the superintendent who had hired him "sight unseen," the latter exploded in picturesque and long drawn out profanity. The young man offered to release the firm from its contract and stay until his successor was installed. On these terms he remained three years.

In Winsted he met Lena Sanford Pond, whom he married on May 13, 1885. The young couple moved to Torrington, Conn., in 1886, where Mr. Hartness spent three years with the Union Hardware Co. as toolmaker and foreman. Here he began the long line of inventions that have marked his career from that day on. These early patents related to such diverse articles as locks, roller skates, and pedal mechanisms for the old-fashioned high bicycle.

Not feeling satisfied with the prospects in Torrington, Mr. Hartness severed his connection with the Union Hardware Co. in 1888, and tried three openings in rapid succession—at the Pratt & Whitney Co. in Hartford, at an engine shop in Scottsdale, Pa., and at the Eaton, Cole & Burnham Co. in Bridgeport, Conn. None of these suited him.

Meanwhile, the Jones & Lamson Machine Co. of Windsor, Vt., had fallen on evil days. It had seen a long interesting history since its founding in the 1830's. The greatest achievement of this firm was the development of the turret lathe, the first manufacturing machine tool in the modern sense. A series of inventions ending in the seventies brought this machine to an improved design and provided business and reputation for the shop in Windsor. But times had changed. Competition had increased, and a varied line made it difficult to manufacture cheaply. Finally, the company became involved in such financial difficulties that it was necessary to sell the business. It was bought by Adna Brown, a Springfield business man who had been looking for an industry to bring to his town in order to help build it up.

The next task was to find a superintendent. There had been some correspondence with James Hartness about certain inventions, one of which the company had bought. The connection was picked up again, and the young man was hired. He came to Springfield in March, 1889.

As superintendent, Mr. Hartness effected certain radical changes in the business. These included a redesign on highly original lines which changed the old "high turret" lathe into the present day "flat turret," and the concurrent invention of a tool equipment for it which vastly extended its field of usefulness and multiplied its output. In addition to this, he performed the revolutionary operation of cutting down the line of products to one type and one size of machine. He dispensed with agents and sold direct, and he instituted the modern practice of artistic and informative sales literature.

Upon the reorganization of the business, Mr. Hartness was assigned a large interest in the firm. He became manager in 1896 and president in 1901, which position he held until his retirement a year ago.

His later life was rich and varied. He further improved the flat turret lathe, adding the cross-sliding head in 1903 and bringing out the double-spindle type of machine for the infant but growing automobile industry in 1910. The Hartness automatic lathe followed, and in later years, the Comparator (an ingenious optical measuring instrument) and the Hartometer (a gage for screw thread inspection), were developed.

Mr. Hartness had a wide range of interests. In 1916, he took the extraordinary step of learning to fly the crude and dangerous airplanes of the time, and obtained an amateur pilot's license. His interest in aviation led him to establish a landing field in Springfield as a memorial to the soldiers and sailors of the World War.

Astronomy also engaged his attention. After suffering from the cold in the outdoor exposure required by his old-fashioned type of telescope, he turned his mind to the problem of devising one that could be used from a sheltered and heated observatory. The result was the "turret equatorial," whose invention gained him membership in American and English astronomical societies.

Mr. Hartness was honored by his fellow engineers in being elected president of the American Society of Mechanical Engineers in 1914. He had previously served as vice-president. In 1924, he was elected president of the Engineering Council. During the war, Mr. Hartness served as Federal Food Administrator under Mr. Hoover and as chairman of the Committee of Public Safety. He also served six years, from 1914 to 1920, as chairman of the Vermont State Board of Education. During the latter part of the war he was a member of the Inter-Allied Aircraft Commission. From 1918 to 1920, he was vice-chairman of the Congressional Screw Thread Commission, whose work standardized bolt and nut threads for the country. In 1921, Mr. Hartness was elected Governor of Vermont.

He was a member of many engineering and scientific societies, among which may be mentioned the American Society of Mechanical Engineers, the American Society of Automotive Engineers, the Institute of Mechanical Engineers (British), the American Astronomical Society, Fellow of the American Association for the Advancement of Science, Fellow of the Royal Aeronautical Society and Royal Society for Encouragement of Arts. He was honored with the degree of M.E. by the University of Vermont in 1910 and L.L.D. in 1921, and by the degree of M.A. by Yale University in 1914. In 1921, he was awarded the John Scott Medal by the board of directors of the City Trusts of Philadelphia and the Edward Longstreth Medal by the Franklin Institute.

He is survived by two daughters, Mrs. William H. Beardsley and Mrs. Ralph E. Flanders.

The many friends of Mr. Hartness throughout the machinery industry will learn of his passing with profound regret. He had one of those rare personalities that, because of its sincerity and friendliness, won the affection of all who came in contact with him. He was always ready to assist others, and to assume duties outside his own business.

NEW BOOKS AND PUBLICATIONS

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1934). 4500 pages, 9 by 12 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York City. Price, $15; renewal subscriptions, $10.

This is the twenty-fourth edition of a well-known directory of American manufacturers, covering every product manufactured in this country. The same arrangement is followed as in previous editions. Following the index or finding list, which is printed on yellow paper for convenient reference, is the main section of the book (printed on white paper), which consists of a classified list of manufacturers arranged, first, according to product, and second, according to geographical location. This section covers 3460 pages. The classified section is supplemented by an appendix giving a list of representative banks, boards of trade, chambers of commerce, and similar commercial organizations, as well as trade papers. An alphabetical list of manufacturers (printed on blue paper) gives home offices, branch offices, subsidiaries, successors, and other data. The trade name section, which is printed on pink paper, contains a list of all the principal trade names of the products included in the main classified section.

This book has proved to be an invaluable aid to executives, purchasing departments, sales departments, engineering departments, research departments, laboratories, superintendents, foremen, and all those having to do with the investigating, buying, and specifying of products or who require lists of manufacturers' names for any other purpose. By its use, it is possible to find the names of all the manufacturers of any product in the United States or in any given state; the names of manufacturers of any trademarked product; the lines manufactured by any manufacturer if the name only is known; and other important information. In addition to the other data, the capital or size rating of each concern is given, so that it is possible to differentiate between the large and small concerns.

ECONOMIC RECOVERY AND THE PREVENTION OF THE RECURRENCE OF DEPRESSION BY RATIONAL STABILIZATION. By Edwin L. Wiegand. 70 pages, 6 by 9 inches. Distributed by E. L. Wiegand Co., Pittsburgh, Pa. Price, $1.

This is a very thoughtful treatise analyzing the causes of industrial depressions and suggesting what appears to be a rational method of stabilization. The author has given much thought and study to the economic structure and is a far better guide than many so-called economists who have written volumes on business depressions in the past.

In studying the tabulation of the distribution of the national income given by the author, one is led to ask, however, why he stops short of advocating, in addition to the rational method of debt revaluation that he proposes, a more rational method of taxation. He estimates that rent of land takes $12,000,000,000, or 15 per cent of the national income in normal years. Since no service is rendered in return for this rent to business, industry, or the nation, it would seem reasonable that a larger proportion of this rent might be appropriated for taxes than is now the case, thereby relieving business and industry of the burden of taxation which it now carries. Such a method of taxation would also materially increase the consumer goods purchasing power, which the author recognizes as the basis of national prosperity.

Although failing to cover this point, the book contains much useful information and valuable suggestions, and will give the thoughtful reader a clear conception of many of the important problems of today.

AMERICA SELF-CONTAINED. By Samuel Crowther. 340 pages, 5 1/2 by 8 1/2 inches. Published by Doubleday, Doran & Co., Inc., Garden City, N. Y. Price, $2.

At a time when so much is being said and written on economic subjects with apparently no serious effort to comprehend the problems facing us, it is refreshing to find a book that makes a determined effort to dig down below the current surface opinions and to establish a few fundamental economic facts. While there are many truths in the realm of economics of extreme importance in the solution of our present difficulties that the author does not touch, the great number of economic questions that he deals with in a thorough and informative manner make the book one that is well worth reading. It will widen the horizon of most readers and will give them a clearer conception of many economic questions, such as our export and import trade, foreign loans, war debts, possibilities of our home markets, and the value of a definite economic policy at home and abroad.

The fact that the author rather overemphasizes those economic difficulties that are due to our foreign trade and political policies, and does not sufficiently emphasize the maladjustments in our domestic economic methods, should not be counted too severely against him, since in other directions he has done such a splendid job and has so clearly stated the fundamental principles underlying all international foreign trade. Everyone who wishes to keep informed on our foreign trade and economic policies will find the time required to read this book well spent.

THE ROMANCE OF RESEARCH. By L. V. Redman, vice-president and director of research, Bakelite Corporation, and A. V. H. Mory, associate director of research, Bakelite Corporation. 149 pages, 5 by 7 1/2 inches. Published by the Williams & Wilkins Co., Baltimore, Md. Price, $1.

This little book is designed to convey to the engineer, the scientific specialist, and intelligent men of affairs generally, a conception of scientific research and its relation to modern life. The book opens with a popular discussion of the viewpoint and method of research and its historical development. Brief attention is given to the mechanical and industrial revolutions. A survey of the achievements of the past century in pure science is followed by a discussion of the part that research has played in the development of new materials and new uses for materials. The book closes with an appeal for research in human relations.

LESSONS IN ARC WELDING. Published in mimeograph form by the Lincoln Electric Co., P. O. Box 683, Cleveland, Ohio. Price, 50 cents, domestic postage prepaid; foreign postage, 25 cents extra.

This pamphlet contains a series of twenty-eight lessons in arc welding, consisting of about sixty mimeographed pages illustrated by sketches. These lessons are based on a course in arc welding given by Arthur Madson at the plant of the Lincoln Electric Co. in Cleveland. They are the result of Mr. Madson's experience in teaching several thousand men to become practical arc-welding operators. The object of the lessons is to present in a concise manner certain fundamental facts about welding, the knowledge of which will enable the operator to use the welding process successfully and economically.

MECHANICAL WORLD YEAR BOOK (1934). 361 pages, 4 by 6 1/4 inches. Published by Emmott & Co., Ltd., 31 King St., W., Manchester, England. Price, 1/6, net.

This well-known little mechanical year book is now in the forty-seventh year of its publication. The new edition includes several entirely new sections, one of the most important of which is that on metals and alloys, which includes methods of heat-treatment. Another new section is that dealing with machine tools. Previous editions have contained a certain amount of tabular matter on this subject, but it has been felt that a fuller treatment would be useful. A third new section deals with press work. In other respects, the book is the same as previous editions and contains a vast fund of data and information which has been carefully revised and brought up to date.

Classified Contents of this Number

Your Progress Depends Upon Your Knowledge of Your Industry